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H.T. HARVEY & ASSOCIATES
Ecological Consultants

South County Right of Way Project
Preliminary Delineation of Wetlands and Other Waters

Project #3270-35

Prepared for:

Santa Clara Valley Water District

Prepared by:

H. T. Harvey & Associates

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Executive Summary

H. T. Harvey & Associate biologists surveyed the Biological Study Area (BSA) for the South County Right of Way Project in Santa Clara and San Benito Counties, California for jurisdictional features that may be subject to regulation under the Clean Water Act, administered by the U.S. Army Corps of Engineers (USACE). Specifically, the 170,755 square foot (3.92 acre) BSA was surveyed for potentially jurisdictional waters, including wetlands and other waters.

The results of the on-site determination are based upon existing conditions present at the time of the surveys. The 30-year normal annual precipitation (1981-2010) for the site is an estimated 19.8 inches, with the majority falling between October and June (PRISM Climate Group 2014). Although the surveys took place during the wet season, the site received approximately 4.7 inches of precipitation since October 2013, only 24 percent of normal annual rainfall (NCDC 2014 and PRISM Climate Group 2014). Approximately 2.45 inches of precipitation fell during the week prior to the March 2014 delineation surveys at the NCDC Campbell Station (GHCND:US1CASC0032), the nearest weather station with recent, daily precipitation data (NCDC 2014). Below-average precipitation likely contributed to a lack of observed or recent hydrology indicators in some locations, but the wetland boundaries remained clear due to the presence of hydrophytic vegetation and persistent hydric soil indicators.

Approximately 4,412 square feet of potential jurisdictional waters were identified within the BSA, including 4,250 square feet of Section 404 wetlands and 162 square feet of Section 404 other waters situated below the ordinary high water mark of Tennant Creek, an unnamed tributary that drains into Ortega Creek, and Elephant Head Creek. All potentially jurisdictional features connect with the Pajaro River, a traditionally navigable water that empties into Monterey Bay. The remaining land within the study area does not meet the definition of wetlands or other waters potentially subject to USACE jurisdiction; this includes 166,343 square feet of upland habitat. The table below summarizes the potential jurisdictional waters within the study area.

Summary of Potential Jurisdictional Waters

Potential Jurisdictional Waters	Square Feet*	Acres*
Section 404 Wetlands	**4,250**	**0.098**
Perennial marsh wetlands	1,527	0.035
Seasonal wetlands	2,723	0.063
Section 404 Other Waters	**162**	**0.004**
Ephemeral Streams	1,527	0.035
Total of Jurisdictional Waters	**4,412**	**0.101**
Upland	**166,343**	**3.819**
Study Area Total	170,755	3.92

*Values are approximate due to rounding errors.

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Section 1.0 Introduction

1.1 Study Area Description

The Biological Study Area (BSA) for the South County Right of Way Project (Project) is located within in unincorporated areas of Santa Clara and San Benito Counties, California between the cities of Morgan Hill and Hollister (Figure 1). The Project is located within the *Gilroy*, *Chittenden*, *San Felipe*, and *Pacheco Peak* U.S. Geological Survey (USGS) 7.5-minute quadrangle maps, in Township 9 South, Range 3 East, Sections 26 and 36; Township 10 South, Range 4 East, Sections 6, 7, 20, 28; Township 10, Range 6 East, Section 24; Township 11 South, Range 4 East, Sections 3, 11, and 13; Township 11 South, Range 5 East, Sections 15, 16 and 17; and Township 11 South, Range 6 East, Section 6 (Figure 2). Google Earth, Version 7.1.2.2041 (Microsoft 2013) shows elevation ranges from approximately 140 feet above mean sea level in the central portion of the BSA, near the border of Santa Clara and San Benito counties, and 450 feet in the eastern portion along Pacheco Creek. The BSA is within the Santa Clara Valley and foothills of the Diablo Mountains. There is little natural topographic variation within the BSA, with the gradient of slopes ranging from 0 to 5 percent (Figure 3). Annual temperature of the BSA ranges from a low of 47.4 to a high of 73.5 degrees Fahrenheit, and annual precipitation is approximately 19.8 inches (PRISM Climate Group 2014).

The BSA includes 27 vault locations of the Santa Clara (SCC) and Pacheco Conduits (PC), which are a part of the of the San Felipe Division conduit and tunnels supplying raw water to both the Santa Clara Valley Water District (SCVWD) and San Benito County Water District (SBCWD). The BSA encompasses a total area of 170,755 square feet (3.92 acres) within the Pajaro River watershed, which flows toward Monterey Bay (Figures 1 and 2). The BSA runs parallel to U.S. Route 101 (US101) and State Route 152 (SR152) and is comprised of rural residences, agricultural land, and ranchland.

Table 1 provides a summary of the 20 soil units mapped in the BSA, along with their associated textures, drainage classification, and hydric soil status (NRCS 2014). Soils are dominated by clay loams, although of variety of soil textures have been mapped on the BSA with a wide range of drainage classifications, from well-drained to poorly drained (Table 1, Figure 3, Appendix B). Hydric soils include Campbell silty clay loam, muck substratum; Clear Lake clay, saline; Cropley clay, 2 to 9 percent slopes; Riverwash; San Ysidro loam, 0-2 percent slopes; and Willows clay. Soils that include hydric inclusions in the Clear Lake series when found in low depressions, or low alluvial floodplains include Campbell silty clay loam; Cropley clay, 0 to 2 percent slopes; Pacheco fine sandy loam; and Pacheco clay loam over clay. Rincon clay loam, 2 to 9 percent slopes contains hydric inclusions within the Cropley series. Mild to moderate alkaline soil types within the BSA include Campbell silty clay loam; Cropley clay, 0 to 2 percent slopes; Pacheco fine sandy loam; Pacheco clay loam over clay; and Willows clay.

The U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) mapping for the BSA is depicted in Figure 4. The NWI identifies several wetland and aquatic features within the vicinity of or in the

BSA (NWI 2014). The portions of Tennant Creek and Elephant Head Creek within the BSA at SCC57 and PC34, respectively, are classified as riverine, intermittent streambeds that are seasonally flooded (R4SBC). At PC 2, Pacheco Creek is classified as riverine, upper perennial, unconsolidated bottom, and permanently flooded (R3UBH). Directly north of the BSA at SCC 18 and 19, the NWI has mapped a palustrine, unconsolidated shore, seasonally flooded wetland within an excavated basin (PUSCx).

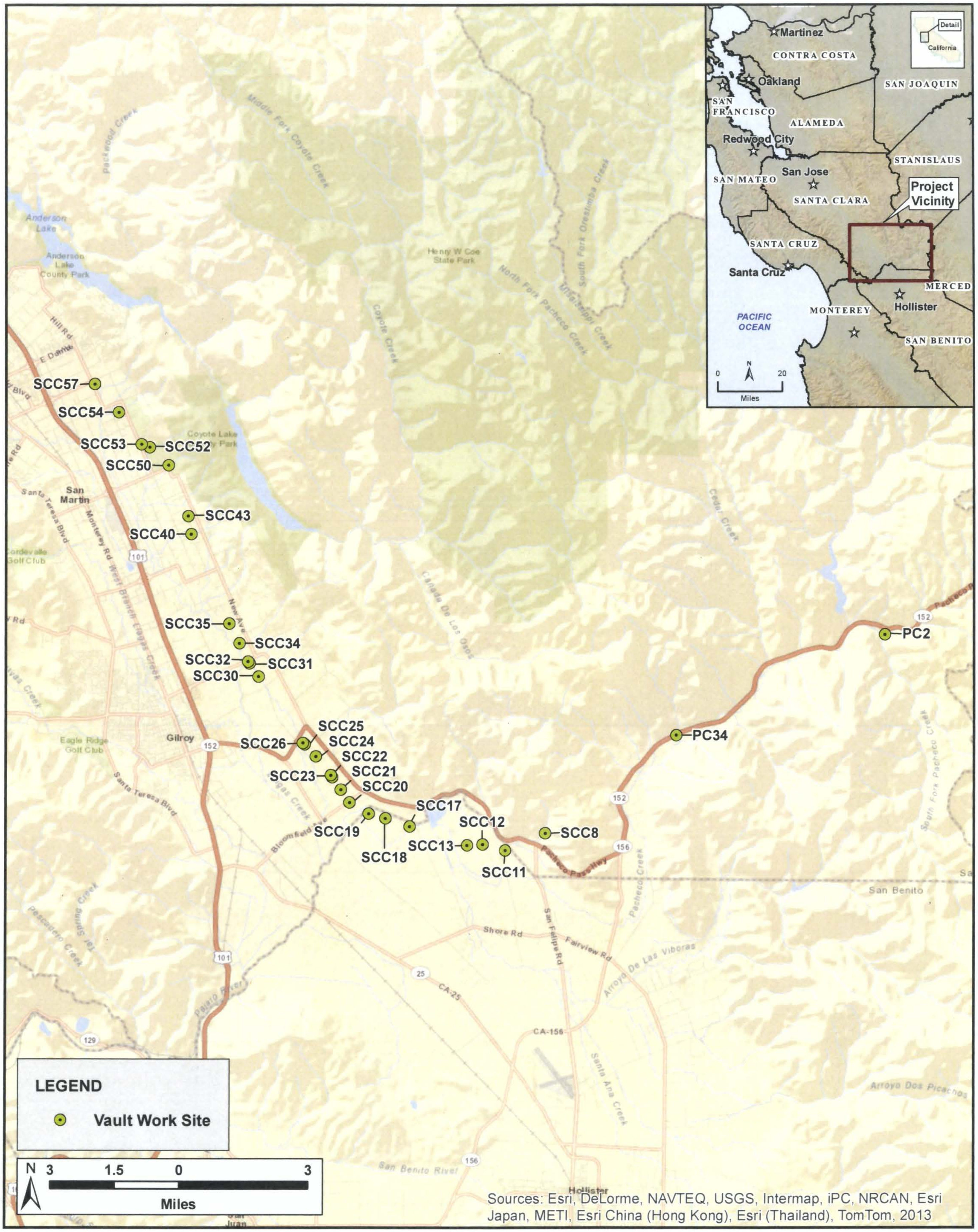
1.2 Project Description

The South County Right of Way Project would obtain new easements for the purpose of accessing existing vaults along the SCC and PC for maintenance and repairs by the SCVWD and SBCWD. The facilities were constructed by the U.S. Bureau of Reclamation (USBR) in the 1980's as a part of the Federal Central Valley Project which conveys water from the water-rich northern part of California to the more arid parts of the state. Full maintenance access easements were not obtained in the 1980's when the pipeline was originally constructed by USBR. The era of obtaining vehicle and worker access by verbal agreement to conduct pipeline maintenance will not likely be viable in future years due to growing development pressure in the region and thus formal access for the pipeline is necessary.

The Project would improve access to these sites by: (1) installing gravel collars around vaults at selected locations so these areas would be kept free weeds and brush for full access by crews; (2) constructing new driveway exits off of public roads to provide access to vaults at selected locations; (3) installing a number of new gates as needed to control safe access at certain vaults; (4) grading for a new gravel access road from SR152 to SCC8; and (5) installing one new sign post at vault SCC 12 to make the vault location more visible to crews. The BSA areas were determined through information provided by Project engineers for each repair location. A small buffer surrounding these expected impacts was also included.

1.3 Survey Purpose

H. T. Harvey & Associates (HTH) surveyed the BSA (Figure 2) on 5, 6, 11, 19 March 2014, 29 April 2014, and 1 May 2014 for areas that may meet the physical criteria and regulatory definition of "waters of the United States" (jurisdictional waters). The purpose of the field surveys was to identify the extent and distribution of potentially jurisdictional waters such as wetlands and other waters occurring within the study area boundaries under conditions existing at the time of the survey.



Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

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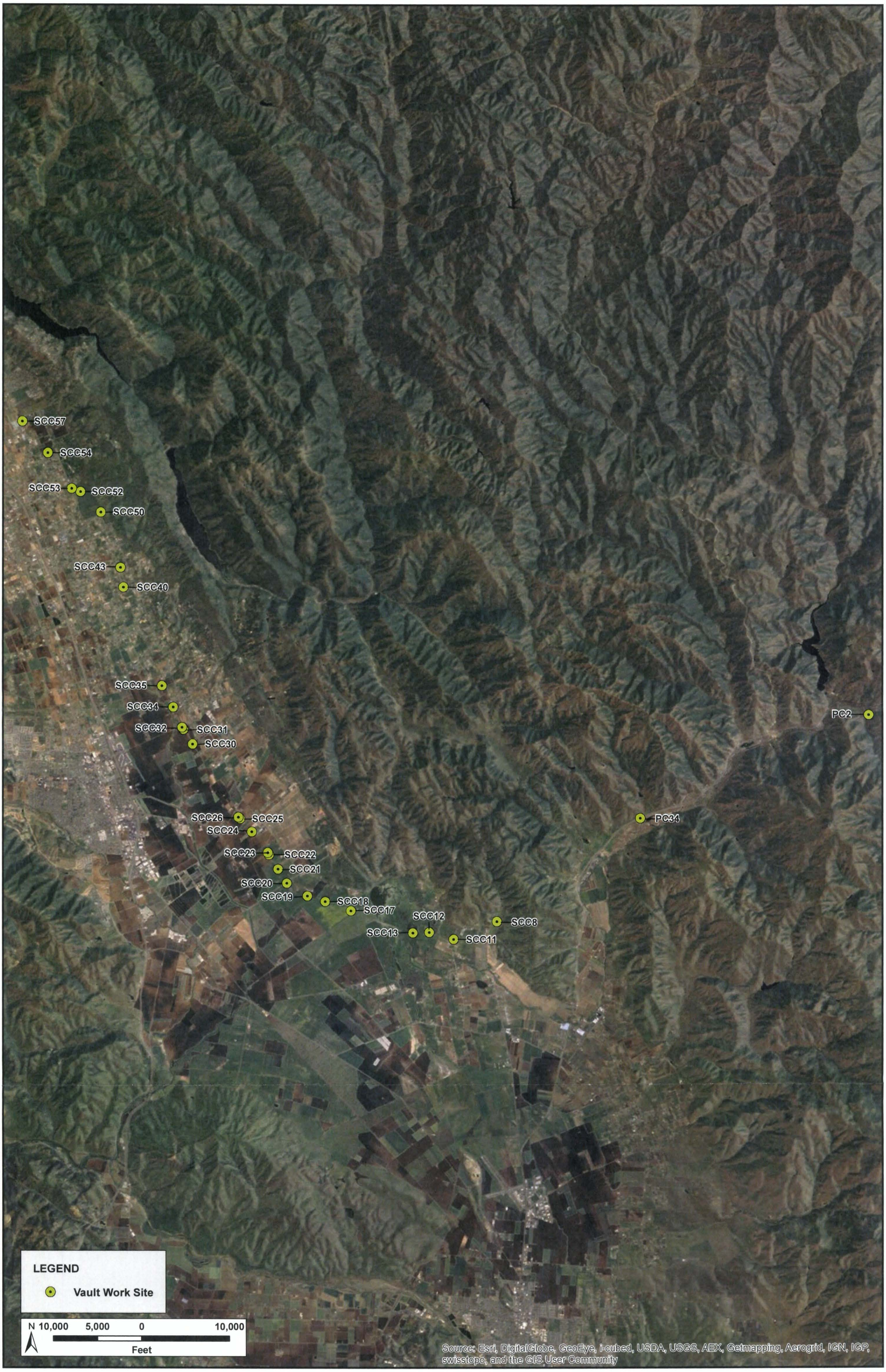
Figure 1: Vicinity Map
SCVWD South County Right of Way Project
ID of Waters of the U.S./STATE (3270-35)
May 2014



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

N:\Projects3200\3270-02\35\Reports\ID of Waters\Fig 2 Study Area and Aerial Photograph.mxd

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Figure 2: Study Area and Aerial Photography
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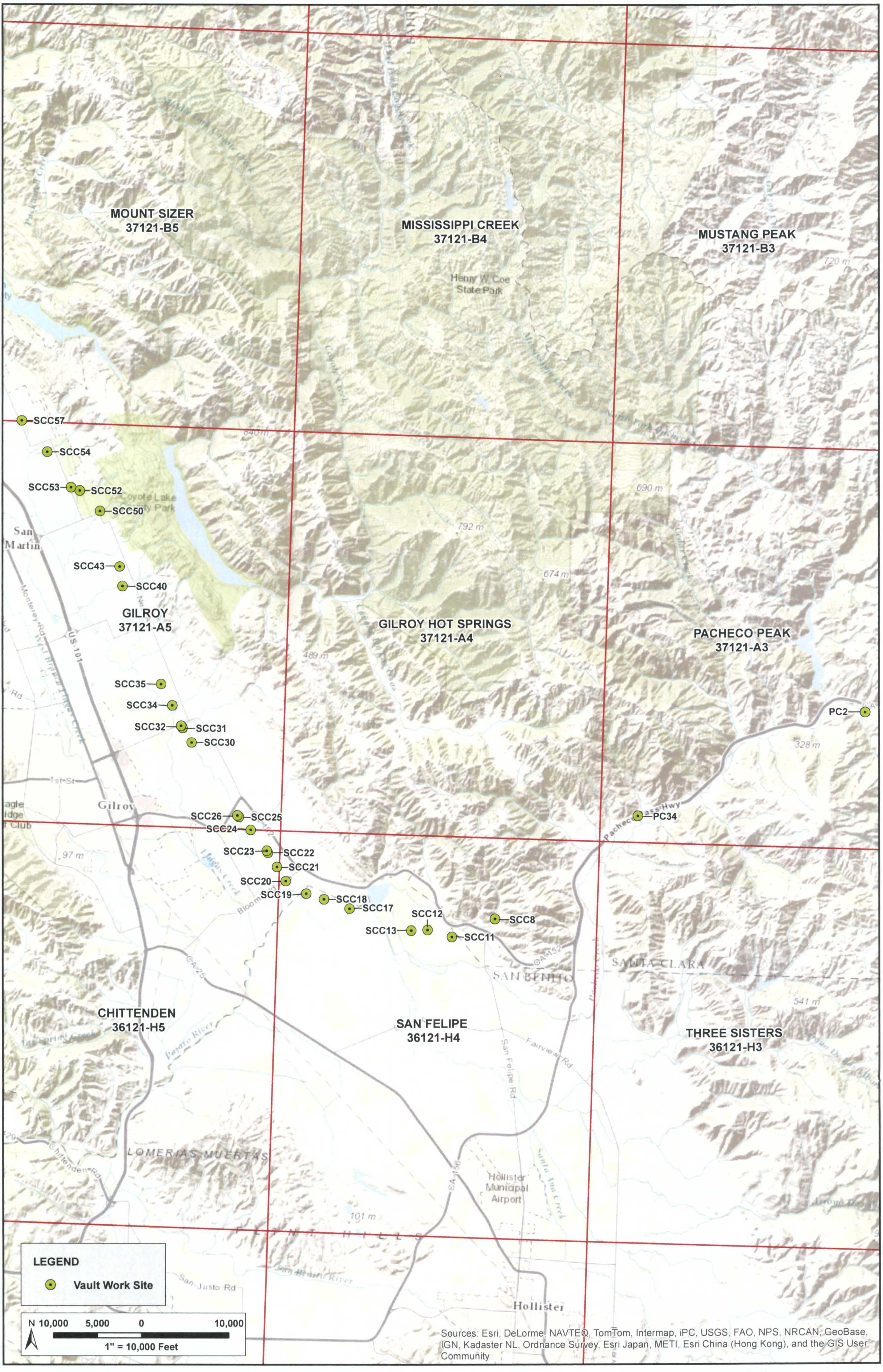

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, iPC, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community

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Figure 3: USGS Topographic Map
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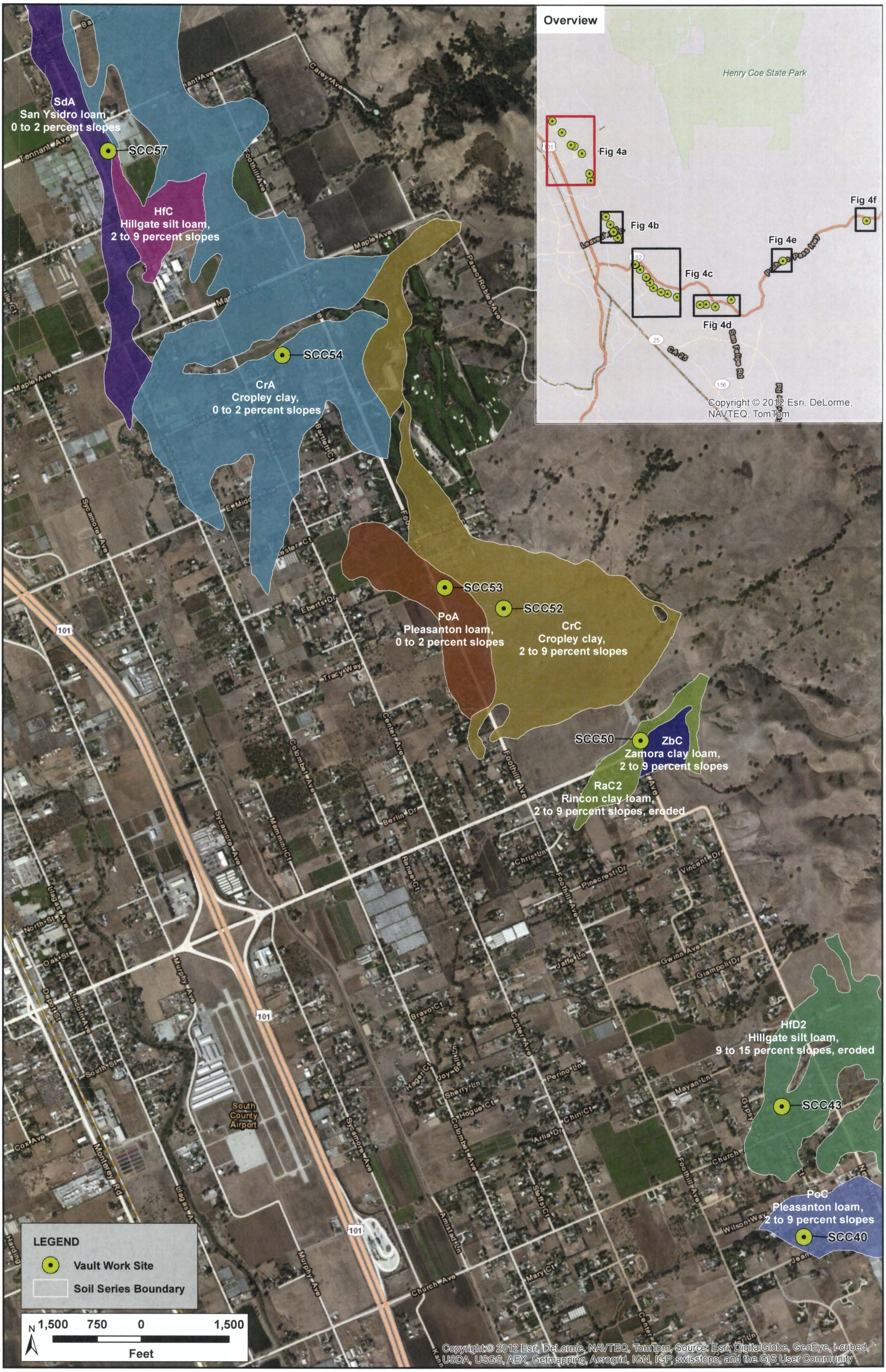
Overview
Henry Coe State Park
Fig 4a
Fig 4b
Fig 4c
Fig 4d
Fig 4e
Fig 4f
Copyright:© 2012 Esri, DeLorme, NAVTEQ, TomTom
SdA
San Ysidro loam, 0 to 2 percent slopes
SCC57
HfC
Hillgate silt loam, 2 to 9 percent slopes
SCC54
CrA
Cropley clay, 0 to 2 percent slopes
SCC53
SCC52
PoA
Pleasanton loam, 0 to 2 percent slopes
CrC
Cropley clay, 2 to 9 percent slopes
SCC50
ZbC
Zamora clay loam, 2 to 9 percent slopes
RaC2
Rincon clay loam, 2 to 9 percent slopes, eroded
HfD2
Hillgate silt loam, 9 to 15 percent slopes, eroded
SCC43
PoC
Pleasanton loam, 2 to 9 percent slopes
SCC40
Tennant Ave
Maple Ave
Foothill Ave
Sycamore Ave
Center Ave
Colombet Ave
Murphy Ave
Monterey Rd
Church Ave
Paseo Robles Ave
101
South County Airport
LEGEND
Vault Work Site
Soil Series Boundary
N
1,500 750 0 1,500
Feet
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Figure 4a: NRCS Soils Map
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
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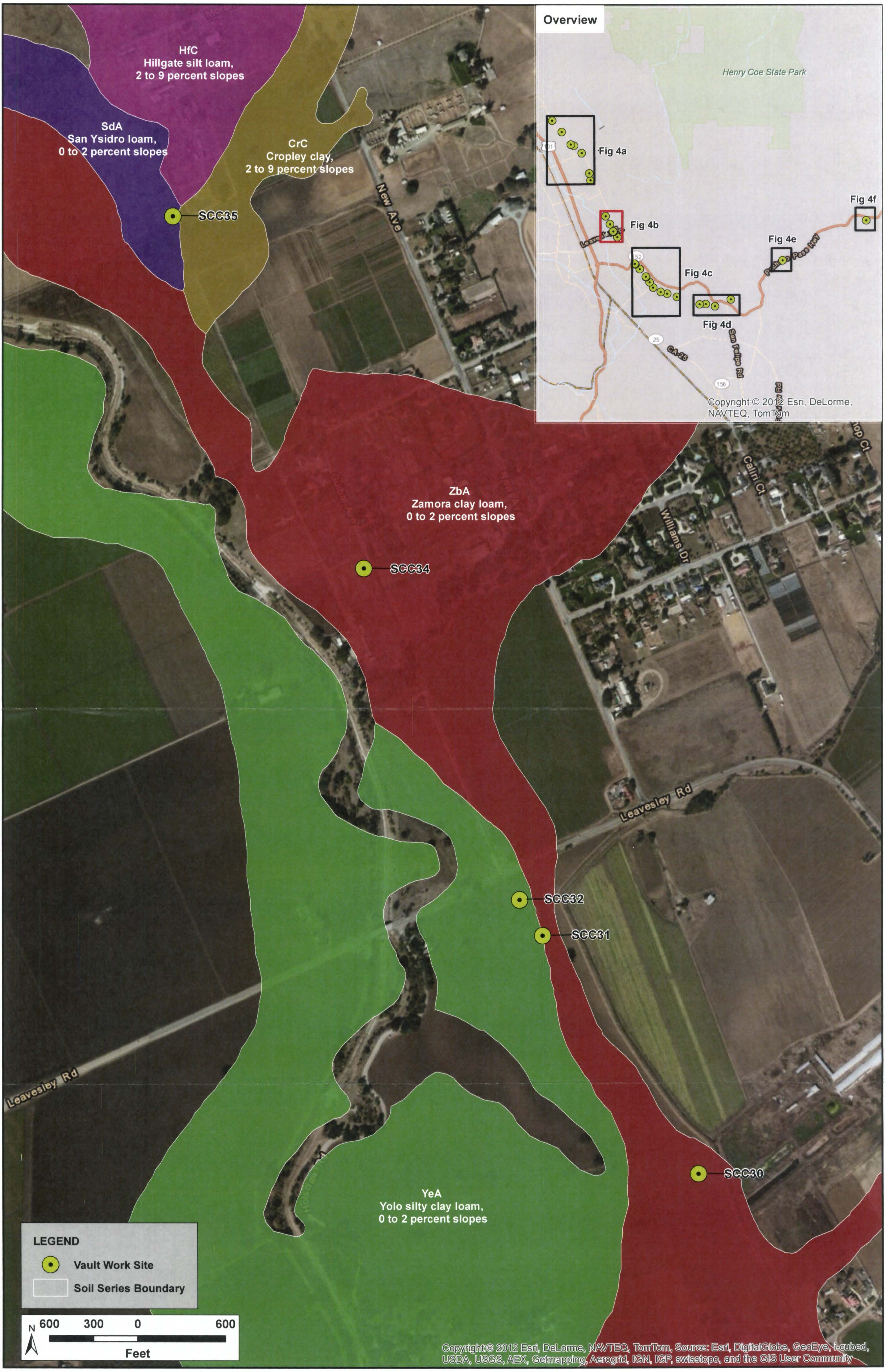

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Figure 4b: NRCS Soils Map
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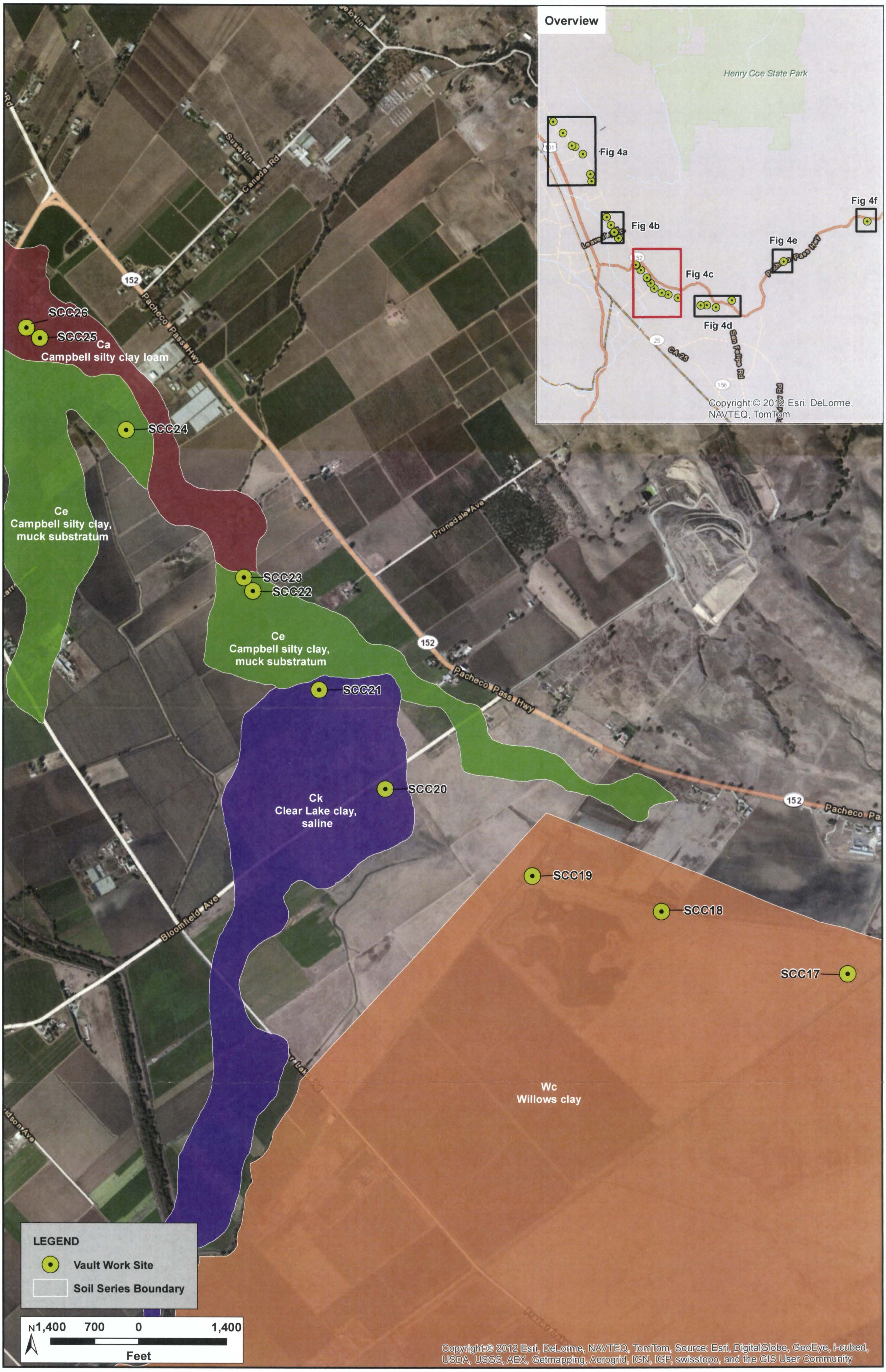

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Figure 4c: NRCS Soils Map

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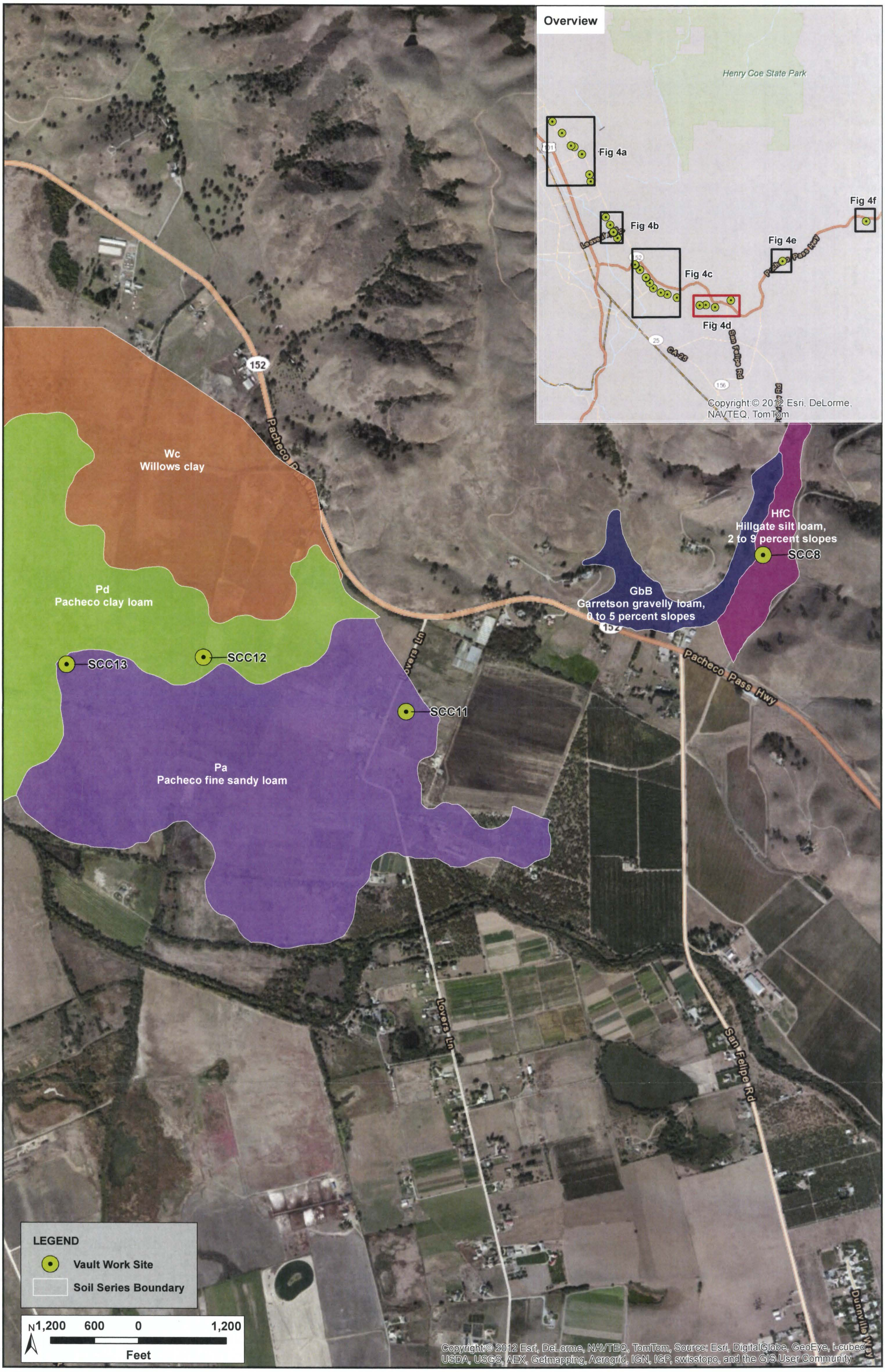

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Figure 4d: NRCS Soils Map
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May 2014

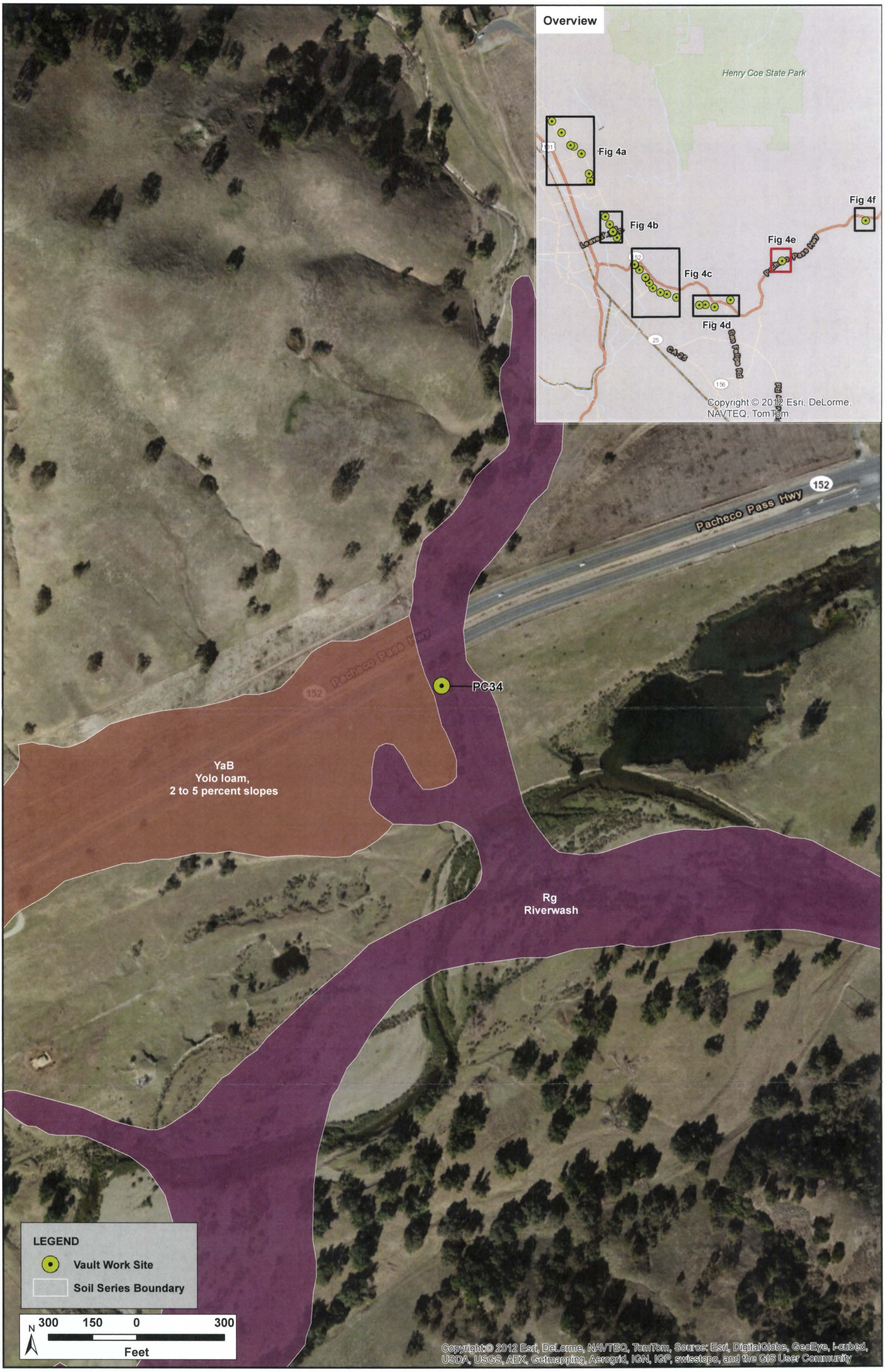

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Figure 4e: NRCS Soils Map
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

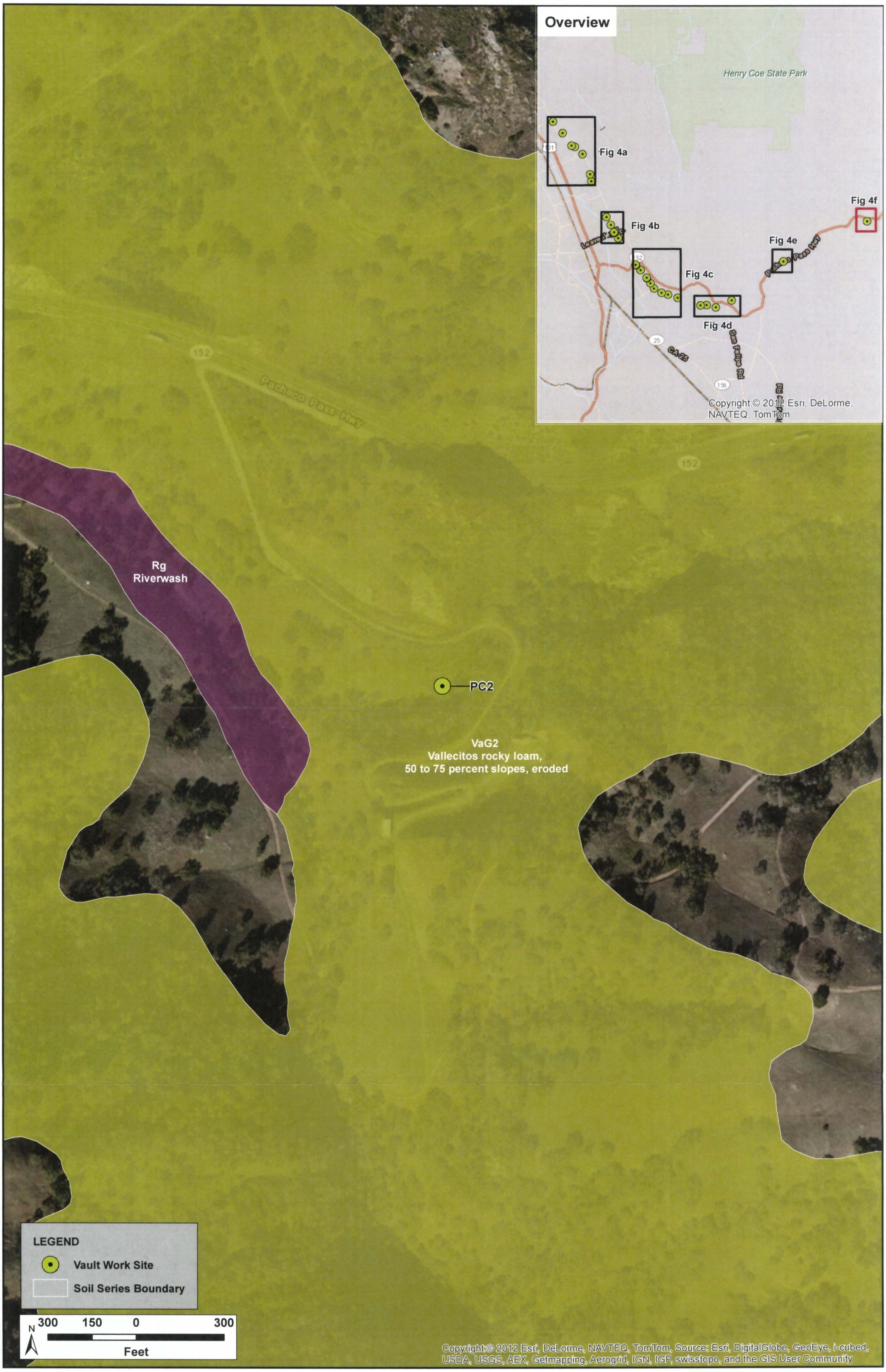

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Figure 4f: NRCS Soils Map
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

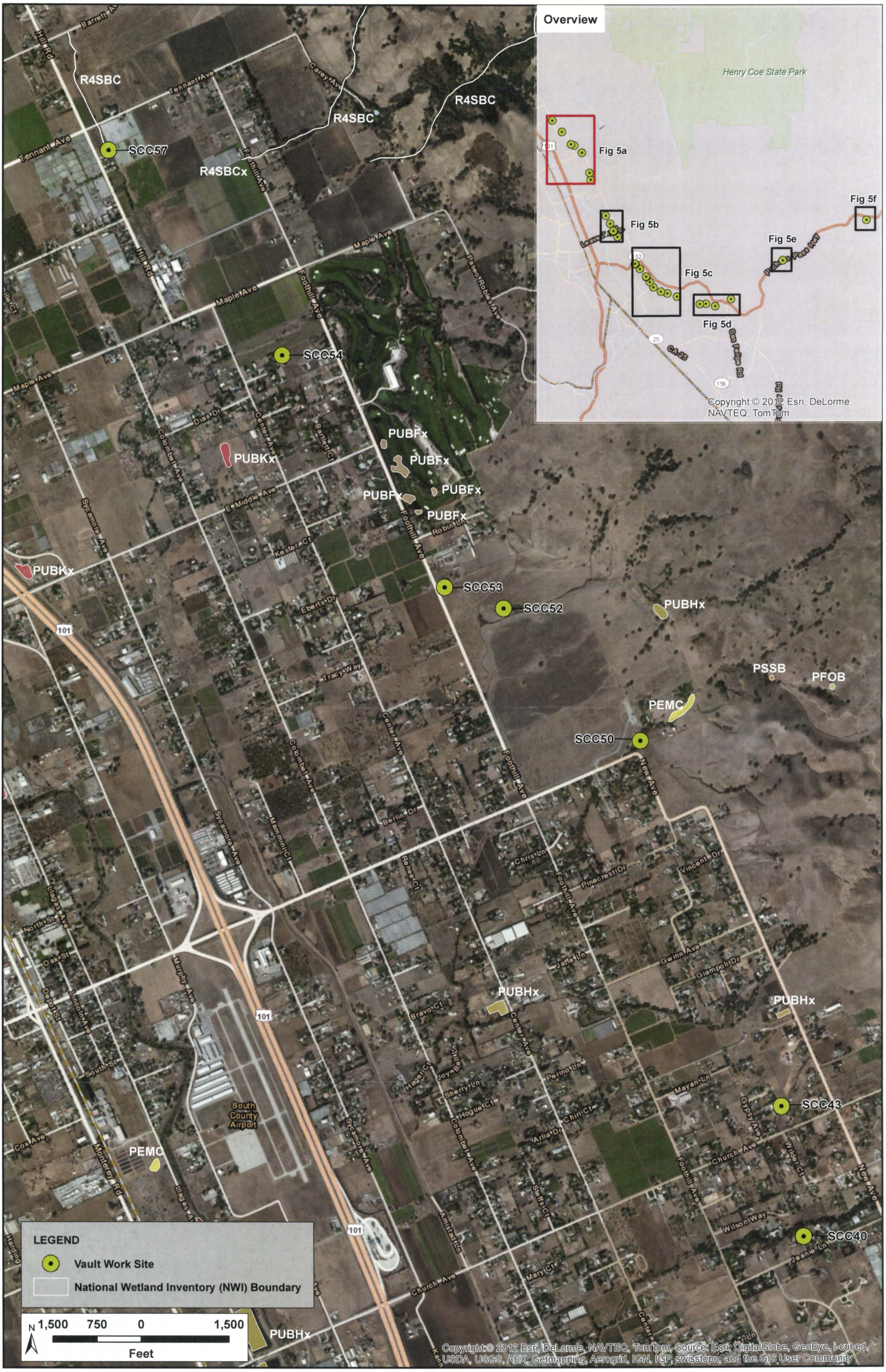

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Figure 5a: NWI Map
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

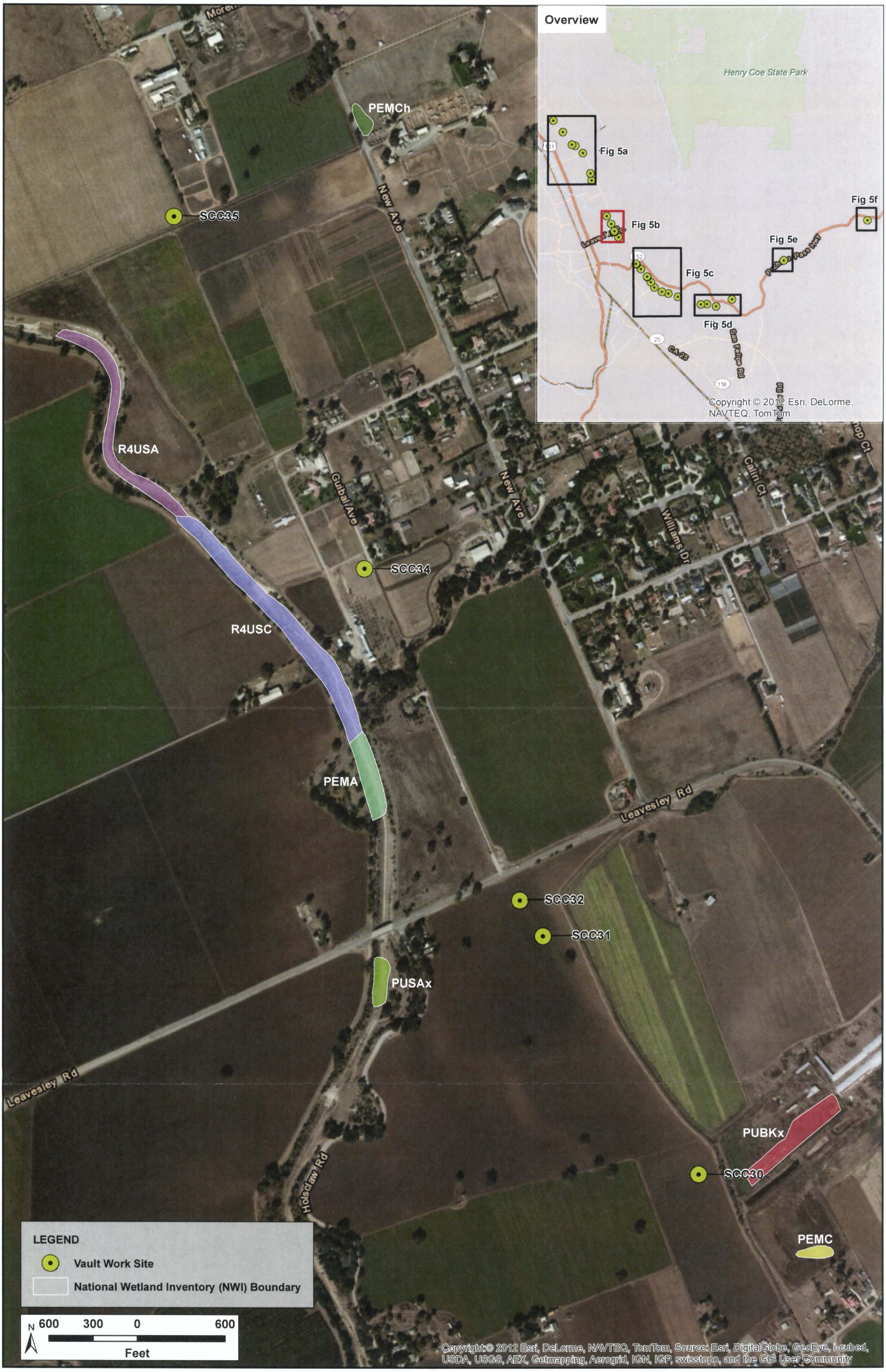

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Figure 5b: NWI Map
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

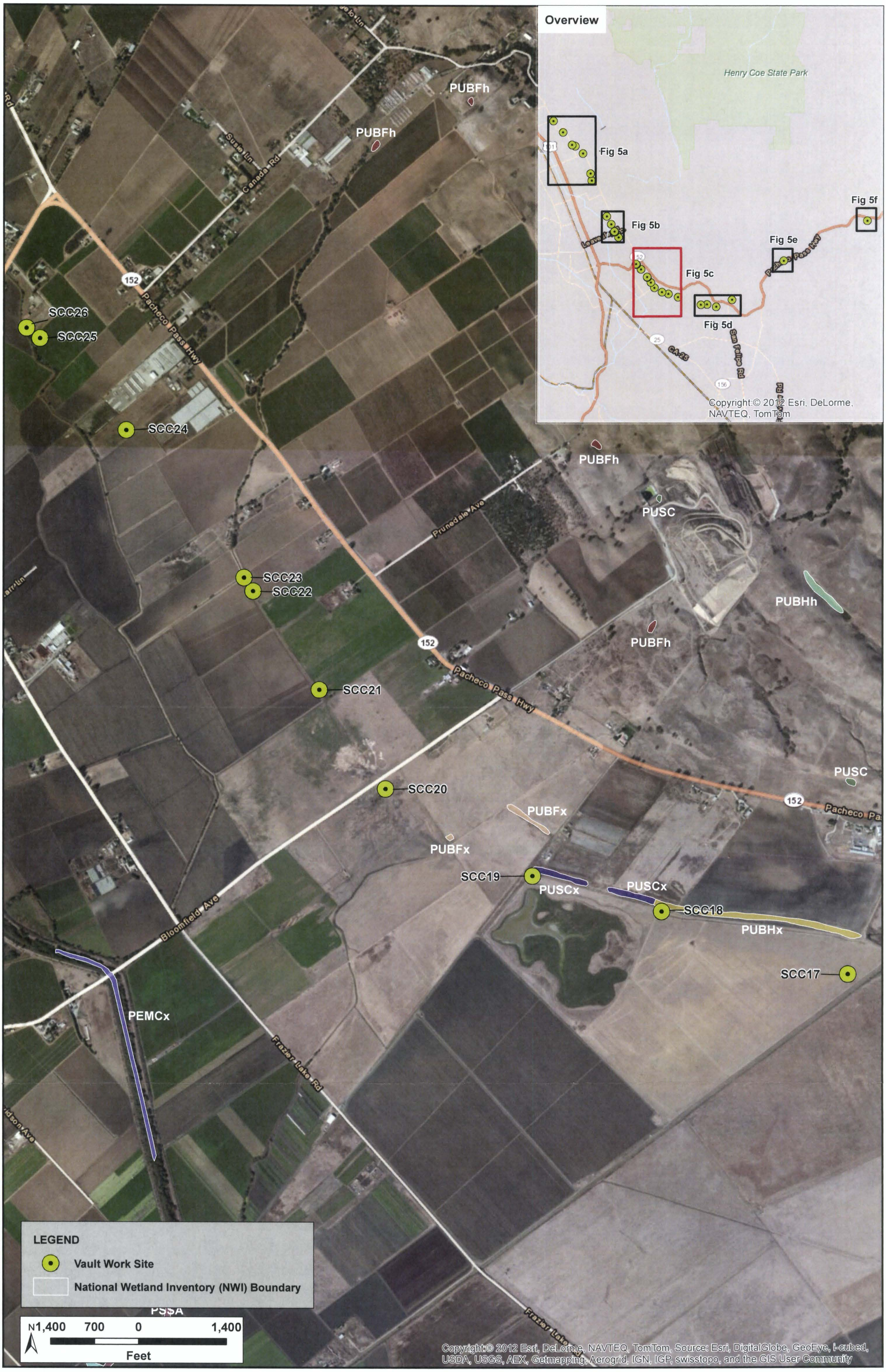

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Figure 5c: NWI Map
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
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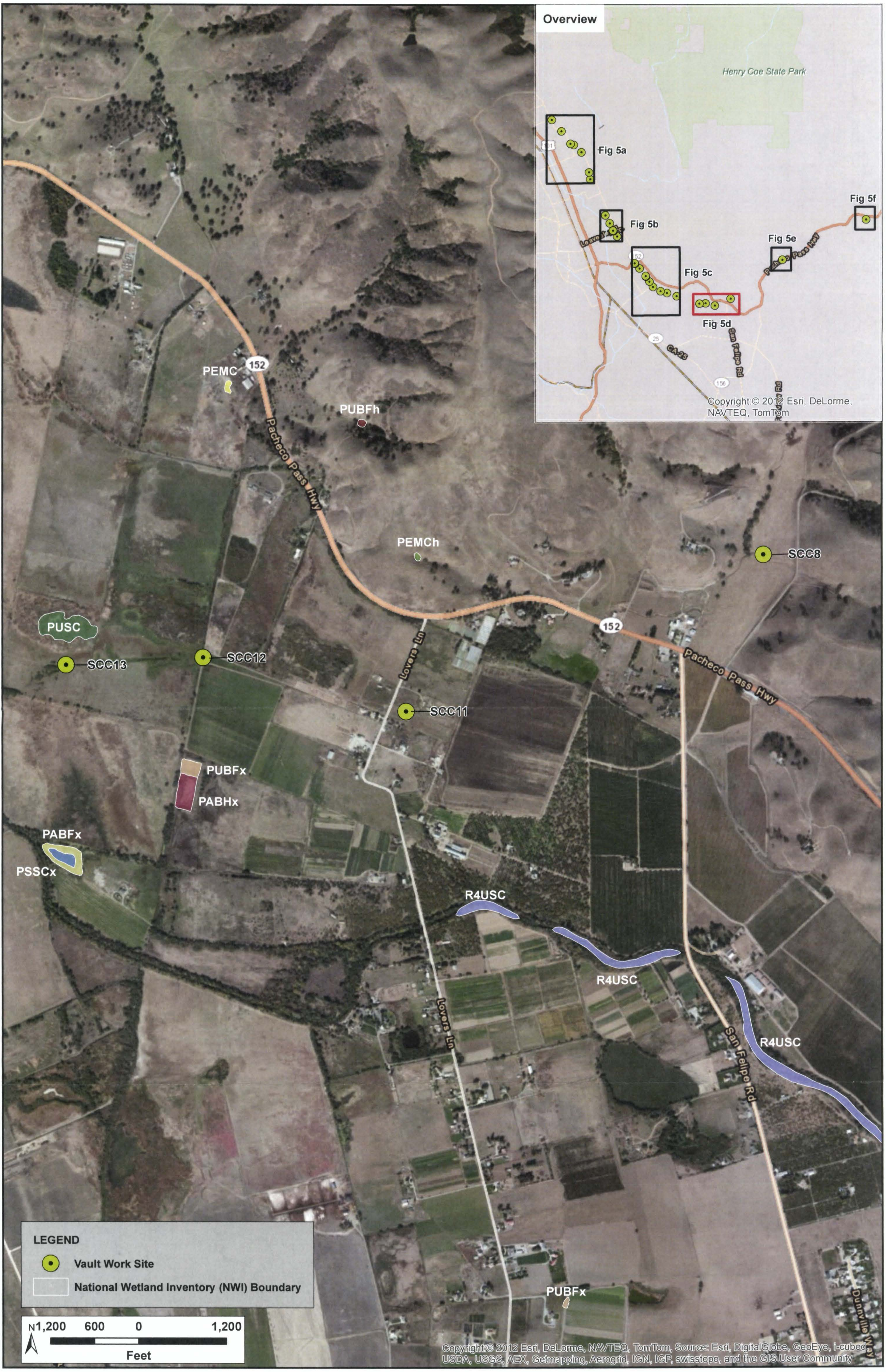

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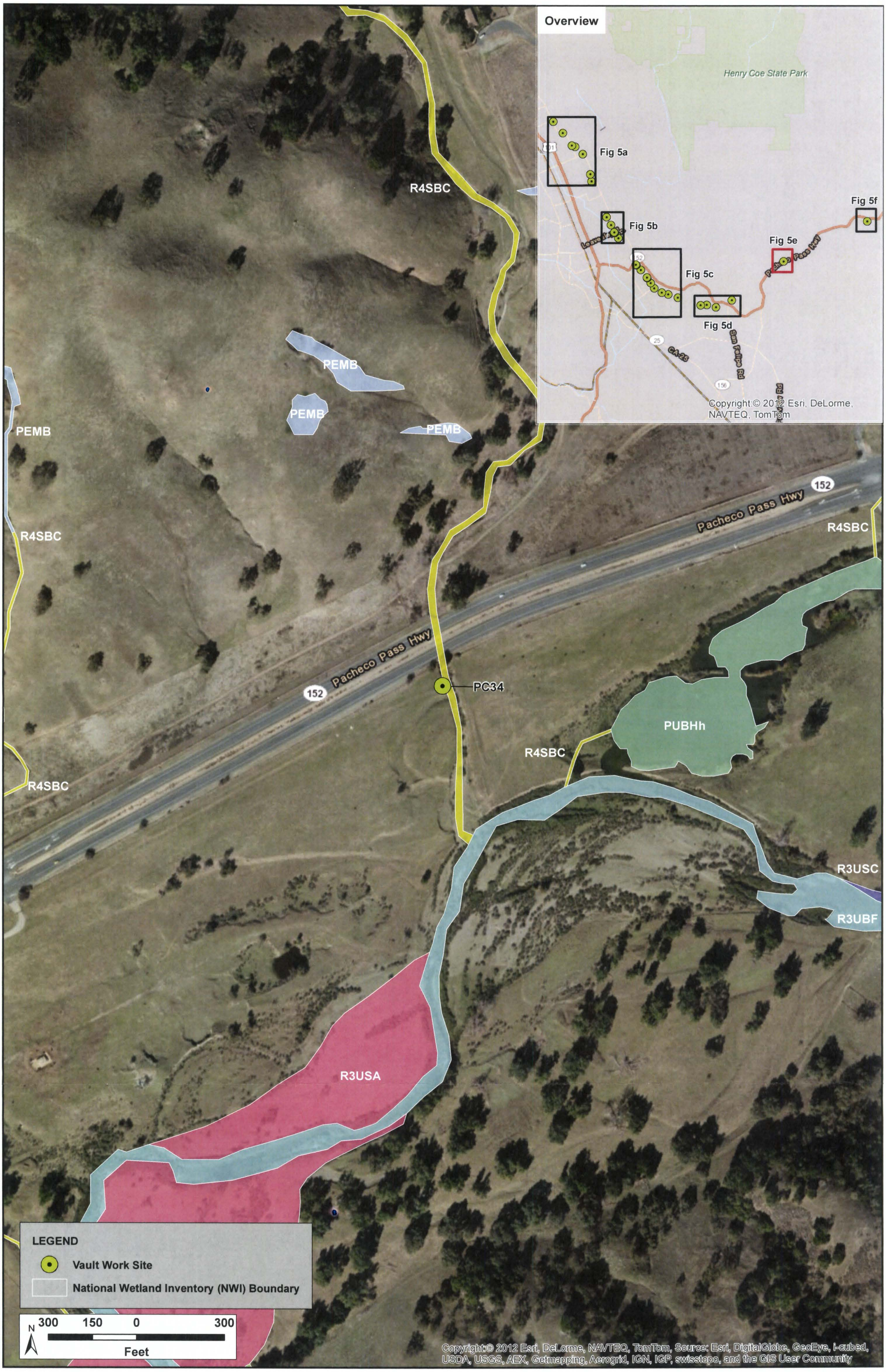
Figure 5d: NWI Map
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014


Overview
Henry Coe State Park
Fig 5a
Fig 5b
Fig 5c
Fig 5d
Fig 5e
Fig 5f
101
152
Leavesley Rd
25
CA-25
San Felipe Rd
156
Pacheco Pass Hwy
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R4SBC
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R4SBC
152
Pacheco Pass Hwy
R4SBC
Pacheco Pass Hwy
152
PC34
R4SBC
PUBHh
R4SBC
R3USC
R3UBF
R3USA
LEGEND
● Vault Work Site
▭ National Wetland Inventory (NWI) Boundary
N
300 150 0 300
Feet
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Figure 5e: NWI Map
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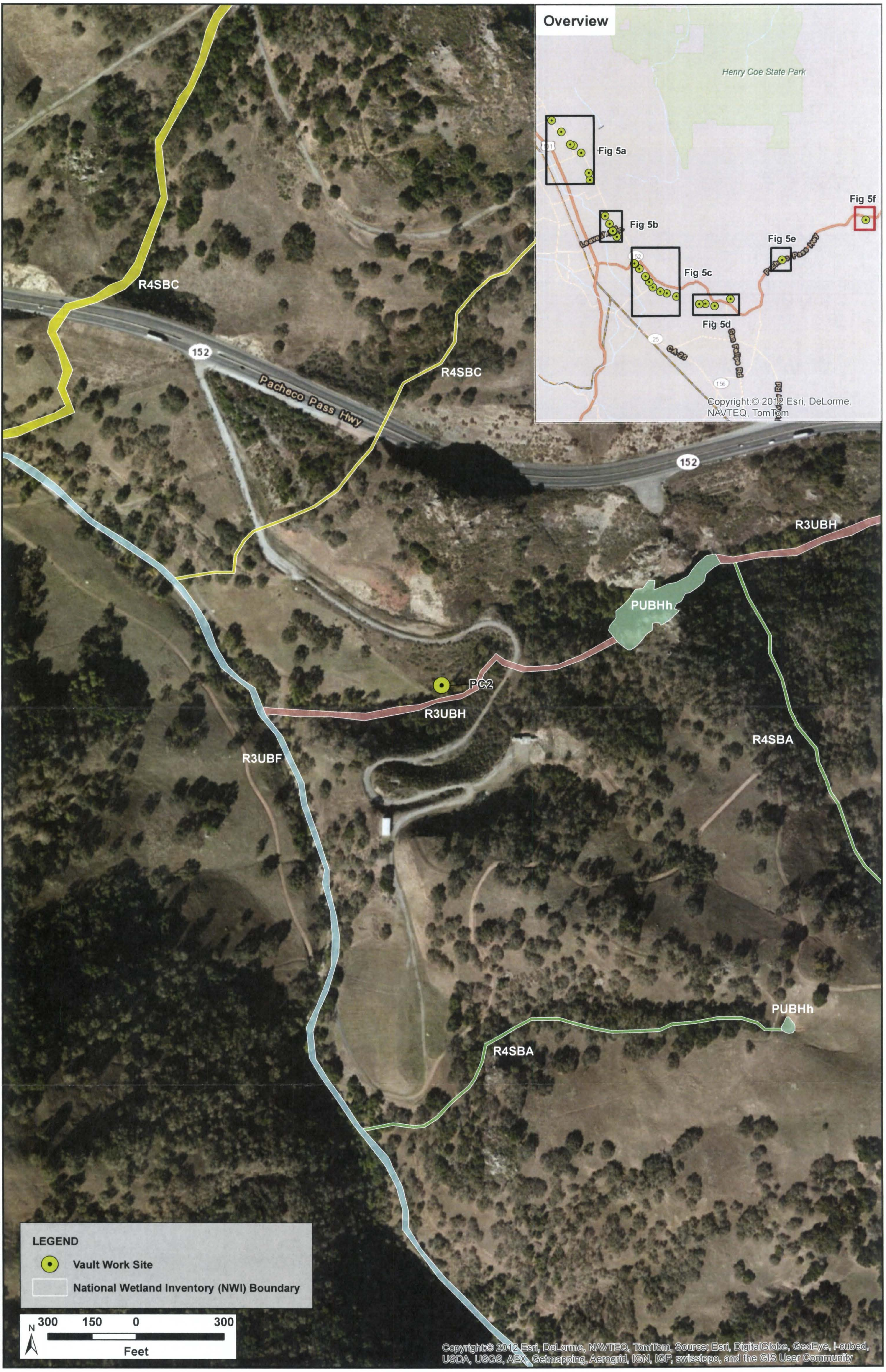
May 2014


Overview
Henry Coe State Park
Fig 5a
Fig 5b
Fig 5c
Fig 5d
Fig 5e
Fig 5f
Leavesley Rd
Pacheco Pass Hwy
CA-25
San Felipe Rd
152
25
156
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R4SBC
R4SBC
152
Pacheco Pass Hwy
152
R3UBH
PUBHh
PC2
R3UBH
R3UBF
R4SBA
PUBHh
R4SBA
LEGEND
Vault Work Site
National Wetland Inventory (NWI) Boundary
N
300
150
0
300
Feet
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N:\Projects3200\3270-02\35\Reports\ID of Waters\Fig 5f NWI Map.mxd

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Figure 5f: NWI Map

SCVWD South County Right of Way

ID of Waters of the U.S./STATE (3270-35)

May 2014

Table 1. Soil Type, Texture, Drainage Classification, and Hydric Soil Status for 20 Different Soil Types Occurring within the BSA

Soil Symbol	Soil Name	Soil Texture	Drainage Classification	Hydric Status
Ca	Campbell silty clay loam	silty clay loam	somewhat poorly drained	Y
Ce	Campbell silty clay loam, muck substratum	silty clay	somewhat poorly drained	Y
Ck	Clear Lake clay, saline	clay	poorly drained	Y
CrA	Cropley clay, 0 to 2 percent slopes	clay	well-drained	Y
CrC	Cropley clay, 2 to 9 percent slopes	clay	well-drained	Y
GbB	Garretson gravelly loam, 0 to 5 percent slopes	gravelly loam	well-drained	N
HfC	Hillgate silt loam, 2 to 9 percent slopes	silt loam	well-drained	N
HfD2	Hillgate silt loam, 9-15 percent slopes, eroded	silt loam	well-drained	N
Pa	Pacheco fine sandy loam	sandy loam	poorly drained	Y
Pd	Pacheco clay loam over clay	clay loam	poorly drained	Y
PoA	Pleasanton loam, 0 to 2 percent slopes	loam	well-drained	N
PoC	Pleasanton loam, 2 to 9 percent slopes	loam	well-drained	N
RaC2	Rincon clay loam, 2 to 9 percent slopes	clay loam	well-drained	Y
Rg	Riverwash	sand, gravel, cobble	not listed	not listed
SdA	San Ysidro loam, 0-2 percent slopes	loam	moderately well-drained	Y
VaG2	Vallecitos rocky loam, 50 to 75 percent slopes, eroded	loam	well-drained	N
Wc	Willows clay	clay loam	poorly drained	Y
YeA	Yolo silty clay loam, 0 to 2 percent slopes	loam	well-drained	N
ZaC	Zamora clay loam, 0 to 2 percent slopes	clay loam	well-drained	N
ZbC	Zamora clay loam, 2 to 9 percent slopes	clay loam	well-drained	N

Section 2.0 Survey Methods

HTH plant biologist, Maya Goklany, M.S., and HTH plant ecologist, Chris Gurney, M.S., covered the entire BSA on foot in March 2014 to determine all potential jurisdictional waters (wetlands and other waters) on the site, and to map these features using sub-meter Global Positioning System (Trimble GeoXT™ GPS unit). The BSA was revisited in April and May 2014 by Maya Goklany to confirm the species of several plant genera that did not initially have the vegetative or reproductive structures necessary for identification.

2.1 Identification of Jurisdictional Waters

The vegetation, soils, and hydrology of the study area were examined following the guidelines outlined in the Routine Determination Method in the *Corps of Engineers 1987 Wetlands Delineation Manual* (Corps Manual; Environmental Laboratory 1987). In addition, the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (Regional Supplement; USACE 2008a) was followed to document site conditions relative to hydrophytic vegetation, hydric soils, and wetland hydrology. As noted in the latter report, the *Regional Supplement* is designed for use with the current version of the Corps Manual, except where superseded by instruction issued in the more recent and location-specific Regional Supplement. This report was also compiled in accordance with guidance provided in *Information Needed for Verification of Corps Jurisdiction* (USACE San Francisco District 2000), *Draft Map and Drawing Standards for the South Pacific Division Regulatory Program* (USACE 2012a), and *Final Map and Drawing Standards for the South Pacific Regulatory Division Regulatory Program* (USACE 2012b). These documents list information that must be submitted as part of a request for a Jurisdictional Determination. This information includes: locality map (Figure 1); study area and aerial photograph (Figure 2); USGS quadrangle sheets (Figure 3); applicable sections of the current soil survey report (Appendix B); wetland delineation data forms (Appendix C); written rationale for sample point choice (Section 3.0, *Survey Results and Discussion*); and color photos (Appendix E).

The study areas were examined for topographic features, drainages, alterations to site hydrology or vegetation, and areas of significant recent disturbance. A determination was then made as to whether normal environmental conditions were present at the time of the field surveys. Data were used to document which portions of the study area were wetlands. Generally, surveys examined the vegetation, soils, and hydrology using the "Routine Determination Method, On-Site Inspection Necessary (Section D)" outlined in the Corps Manual, and using the updated data forms, vegetation sampling methods, and hydric soil and hydrology indicators developed for the Regional Supplement (USACE 2008a). This three-parameter approach to identifying wetlands is based upon the presence of hydrophytic vegetation, hydric soils, and wetland hydrology. Alternatively, a two-parameter approach to identifying wetlands is utilized in situations where vegetation, soils, or hydrology indicators are absent due to human activities or natural events, and is described in the "Difficult Wetland Situations in the Arid West" (USACE 2008a).

Prior to site surveys, topographic maps and aerial photographs of the study area were obtained from several sources and reviewed. These sources included the USGS, NWI, and Google Earth (Microsoft 2013). Overall, the approach used to identify wetlands included digging 20-inch soil pits to identify hydric indicators, observing vegetative cover in proximity to the sampling location and identifying hydrophytic plant species, and determining current surface and subsurface hydrologic features present near the sampling location. Features meeting these criteria were then mapped in the field using a Trimble GeoXT™ GPS unit. A brief overview of the USACE methodology specifically applicable to the identification of jurisdictional waters on the site is summarized below.

2.2 Identification of Section 404 Wetlands

2.2.1 Vegetation

Plants observed at each of the sample sites were identified to species, when possible, using *The Jepson Manual, Vascular Plants of California, Second Edition* (Baldwin et al. 2012). The wetland indicator status of each species was obtained from the Arid West 2013 Regional Wetland Plant List (Lichvar 2013). The recent revision of plant names within the Jepson Manual has led to several differences in nomenclature between the latest Jepson Manual and the 2012 Wetland Plant List. In these cases, synonyms recognized by Calflora (2013) were also searched for their indicator status. A list of species for each observation area was then compiled and a visual estimate of the percent cover of plant species was made following guidance provided in the Regional Supplement. It was then determined which of the observation areas supported wetland vegetation using the applicable Indicator (i.e., 1-Dominance Test; 2-Prevalence Test; or, 3-Morphological Adaptations) as described in the Regional Supplement.

Wetland indicator species are designated according to their frequency of occurrence in wetlands. For instance, a species with a presumed frequency of occurrence of 67 to 99 percent in wetlands is designated a facultative wetland indicator species. The five basic levels of wetland indicator groups, described in the Regional Supplement do not include plus (+) or minus (-) indicators. The wetland indicator groups, indicator symbol, and the frequency of occurrence of species within them in wetlands are presented in Table 2.

Table 2. Wetland Indicator Status Categories for Vascular Plants

Indicator Category	Symbol	Frequency of Occurrence
Obligate	OBL	greater than 99%
Facultative Wetland	FACW	67 - 99%
Facultative	FAC	34 - 66%
Facultative Upland	FACU	1 - 33%
Upland	UPL	less than 1%

* Based upon information contained in *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987).

Obligate and facultative wetland indicator species are hydrophytes that occur "in areas where the frequency and duration of inundation or soil saturation produce permanently or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present" (Environmental Laboratory 1987). Facultative indicator species may be considered wetland indicator species when found growing in hydric soils that experience periodic saturation. A complete list of the vascular plants observed within the study area, and their current indicator status has been provided in Appendix A. Plants species that are not on the regional list of wetland indicator species are considered upland species.

2.2.2 Soils

Where possible, the top 20-inch of the soil profile was examined for hydric soil indicators. Diagnostic features include numerous indicators defined and described by the National Technical Committee for Hydric Soils. These indicators include the presence of Histosols (A1) (organic soils), histic epipedons (A2), hydrogen sulfide odor (A4), depleted matrix (F3), redox depressions (F8), redox dark surface (F6), and mottling indicated by the presence of gleyed or bright spots of colors (in the former case, blue grays; in the latter case, orange red, or red brown) within the soil horizons observed, among other features. Munsell Soil Notations (Munsell 2009) were recorded for the soil matrix for each soil sample. The last digit of the Munsell Soil Notation refers to the chroma of the sample. This notation consists of numbers beginning with 0 for neutral grays and increasing at equal intervals to a maximum of about 20. Soil matrix chroma values that are one (1) or less, or two (2) or less when mottling is present, are typical of soils which have developed under anaerobic conditions. The first digit of the Munsell Soil notation refers to the value of the sample, with numbers beginning from 2 for saturated colors to a maximum of about 8 for faded or light colors. Hydric soils often show low value colors when soils have accumulated sufficient organic material to indicate development under wetland conditions, but can show high value colors when iron depletion has occurred, removing color value from the soil matrix.

The Soil Survey of Eastern Santa Clara County, California (SCS 1974) and *The Soil Survey of San Benito County, California* (SCS 1969) were consulted to determine which soil types have been mapped in the study area (see Table 1). Detailed descriptions of these soil mapping units are provided in Appendix B.

2.2.3 Hydrology

Each of the sample sites was examined for positive field indicators (primary and secondary) of wetland hydrology following the guidance provided in the Regional Supplement. Primary indicators might include visual observation of surface water (A1), high water table (A2), soil saturation (B1), water-stained leaves (B9), and hydrogen sulfide odor (C1). Secondary indicators might include riverine drift deposits (B3), drainage patterns (B10), and passing score for the FAC-neutral test (D5).

2.3 Identification of Section 404 Other Waters

In concert with the USACE's efforts to revise the wetland delineation manuals, making them more specific to different geographic regions of the United States, as described above, efforts have been initiated by the USACE to develop an ordinary high water (OHW) delineation manual. In particular, five relatively recent publications have attempted to further refine the definition of OHW and the delineation of the OHW mark in the arid west (including California):

- *Review of Ordinary High Water Mark Indicators for Delineating Arid Streams in the Southwestern United States* (USACE 2004);
- *Distribution of Ordinary High Water Mark (OHWM) Indicators and Their Reliability in Identifying the Limits of "Waters of the United States" in Arid Southwestern Channels* (USACE 2006);
- *Review and Synopsis of Natural and Human Controls on Fluvial Channel Processes in the Arid West* (USACE 2007);
- *A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States: A Delineation Manual* (USACE 2008b); and
- *Updated Datasheet for the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States* (USACE 2010).

Historically, in non-tidal waters, USACE jurisdiction extends to the OHW mark which is defined in 33 CFR Part 328.3 as "the line on the shore established by the fluctuations of water and indicated by physical characteristics, such as a clear, natural line impressed on the bank, shelving, changes in the character of the soil, destruction of terrestrial vegetation or the presence of litter and debris." This guidance is based upon the identification of the OHW mark by examining physical evidence of surface flow in the stream channel; there is no hydrologic definition of the OHW mark.

In addition, *Regulatory Guidance Letter 05-05* (dated: 7 December 2005) deals specifically with the topic of OHW mark identification. That publication lists the following physical characteristics that should be considered when making an OHW mark determination: (1) natural line impressed on the bank; (2) shelving; (3) changes in the character of the soil; (4) destruction of terrestrial vegetation; (5) wracking; (6) vegetation matted down, bent, or absent; (7) sediment sorting; (8) leaf litter disturbed or washed away; (9) scour; (10) deposition; (11) multiple observed flow events; (12) bed and banks; (13) water staining; and (14) and change in plant community.

Just as with the Corps Manual, development of the definition of the OHW mark and description of the field indicators to be used were primarily based on environmental conditions present in more temperate climates of the United States. In these areas, rain distribution and amounts are more consistent from one year to the next and the channel geomorphology has responded to develop field characteristics that reflect a system in relative equilibrium. Such "ordinary" precipitation events occurring in these temperate climates are more likely to cause the development of "ordinary" features commonly used by the USACE in identifying the OHW mark as defined under 33 CFR Part 328.3.

The difficulty with this approach is that the environmental conditions present in the arid west are very different than those encountered in temperate climates. In particular, the Mediterranean climate present throughout central California is characterized by a high degree of seasonal and inter-annual variability in precipitation. Occurrences of drought conditions followed by extreme discharges are more common in the arid west. Thus, much of what is observed in the field in terms of geomorphic features such as channel down-cutting, erosion, and channel formation, is not in response to "ordinary" precipitation events but to relatively high intensity and infrequent rainfall events.

For purposes of the current study, the identification of the OHW mark in the field was based upon observation of a suite of natural geomorphic field indicators that have formed during channel forming events. These features included staining of rocks and culverts, erosion of soil to bedrock, and channel bed morphology, among other factors.

The presence of one or more of the natural geomorphic field indicators listed above, taking into consideration such factors as size of watershed, channel slope, landscape setting, elevation, gradient, land use practices, and soil type, were taken as direct evidence of an OHW mark and such channels were identified as "other waters."

Section 3.0 Survey Results and Discussion

Sixteen formal sample points were taken throughout the study area during the March 2014 delineation survey (Figure 6a-b, 6d, 6q-t, 6w-x, and 6za; Appendices C and D). Within the study area boundaries, approximately 4,412 square feet of potential jurisdictional waters were identified (Figures 6a, 6d 6q, 6s, 6w-za). This included roughly 4,250 square feet of Section 404 wetlands and 162 square feet of other waters (Table 3). Following this section we've included Figures 6a through 6za. Each figure shows the project boundary, soil pits (if any), top of bank and jurisdictional features, if encountered on site. Additionally, in the lower left hand corner of each figure is an overview inset that shows the location of each figure along the project route. Table 3 below summarizes the jurisdictional waters within the study area and the matrix below summarizes information pertinent to each of the 27 vault locations.

Table 3. Summary of Jurisdictional Waters within the Study Area

Potential Jurisdictional Waters	Square Feet*	Acres*
Section 404 Wetlands	**4,250**	**0.098**
Perennial marsh wetlands	1,527	0.035
Seasonal wetlands	2,723	0.063
Section 404 Other Waters	**162**	**0.004**
Ephemeral Streams	1,527	0.035
Total of Jurisdictional Waters	**4,412**	**0.101**
Upland	**166,343**	**3.819**
Study Area Total	170,755	3.92

*Values are approximate due to rounding errors.

Information pertinent to the identification of jurisdictional wetlands and other waters assembled during this investigation is presented in six appendices attached to this report. Please note Appendix F has also been provided as an electronic attachment in Microsoft Excel format, per USACE (2012) guidelines.

- Appendix A — Plants Observed
- Appendix B — Soils of Eastern Santa Clara County, CA and Soils of San Benito County, CA
- Appendix C — USACE Arid West Wetland Determination Data Forms
- Appendix D— USACE Arid West OHWM Data Forms
- Appendix E — Photo-documentation of the BSA
- Appendix F — Aquatic Resources Table

Summary matrix listing the report figure number, jurisdictional feature identifier, Appendix C and D data forms, soil pit number, and Appendix E photography number for each of the 27 different vault study areas.

PC/SCC Number	Figure Number	Jurisdictional Feature	Appendix C/D Data Form	Appendix E Photograph
PC 2	6za	SW2	SP2a/b	40-43
PC 34				
SCC 5				
SCC 6				
SCC 8				
SCC 11	6x	SW11	SP11b	4
SCC 12				
SCC 13	6v (no project boundary shown)			
SCC 17				
SCC 18				
SCC 19	6s	SW19	SP19a	9
SCC 20				
SCC 21	6q	SW21	SP21a	12
SCC 22				
SCC 23				
SCC 24				
SCC 25				
SCC 26				
SCC 29				
SCC 30				
SCC 31				
SCC 32				
SCC 34				
SCC 35				
SCC 40				
SCC 43				
SCC 44				
SCC 50				
SCC 52	6d	SW52	SP52a/b	30-32
SCC 53				
SCC 54				
SCC 55				
SCC 56				
SCC 57	6a	SW57a/b ES57	SP57a/b OHW57a/b	39
SCC 60				

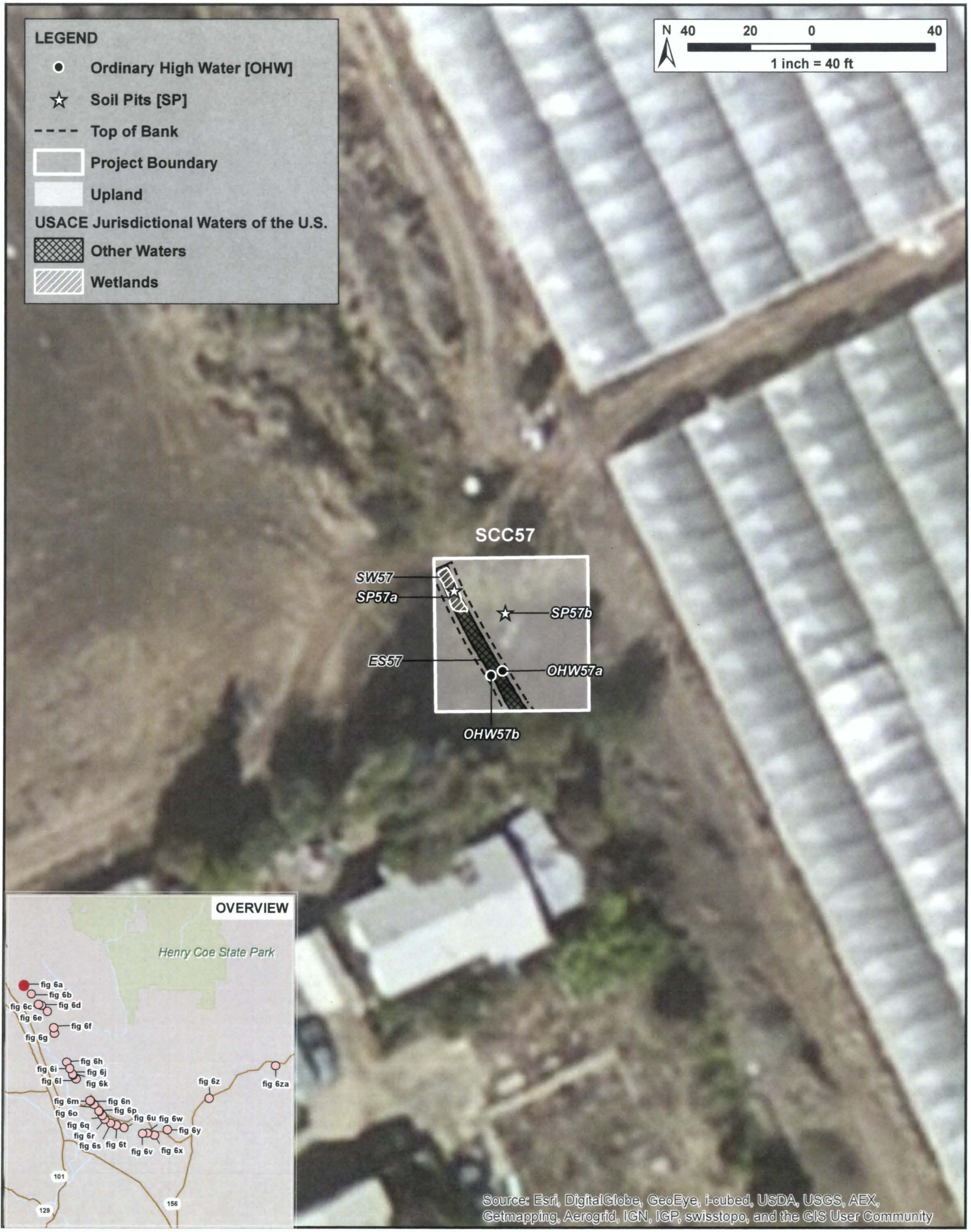

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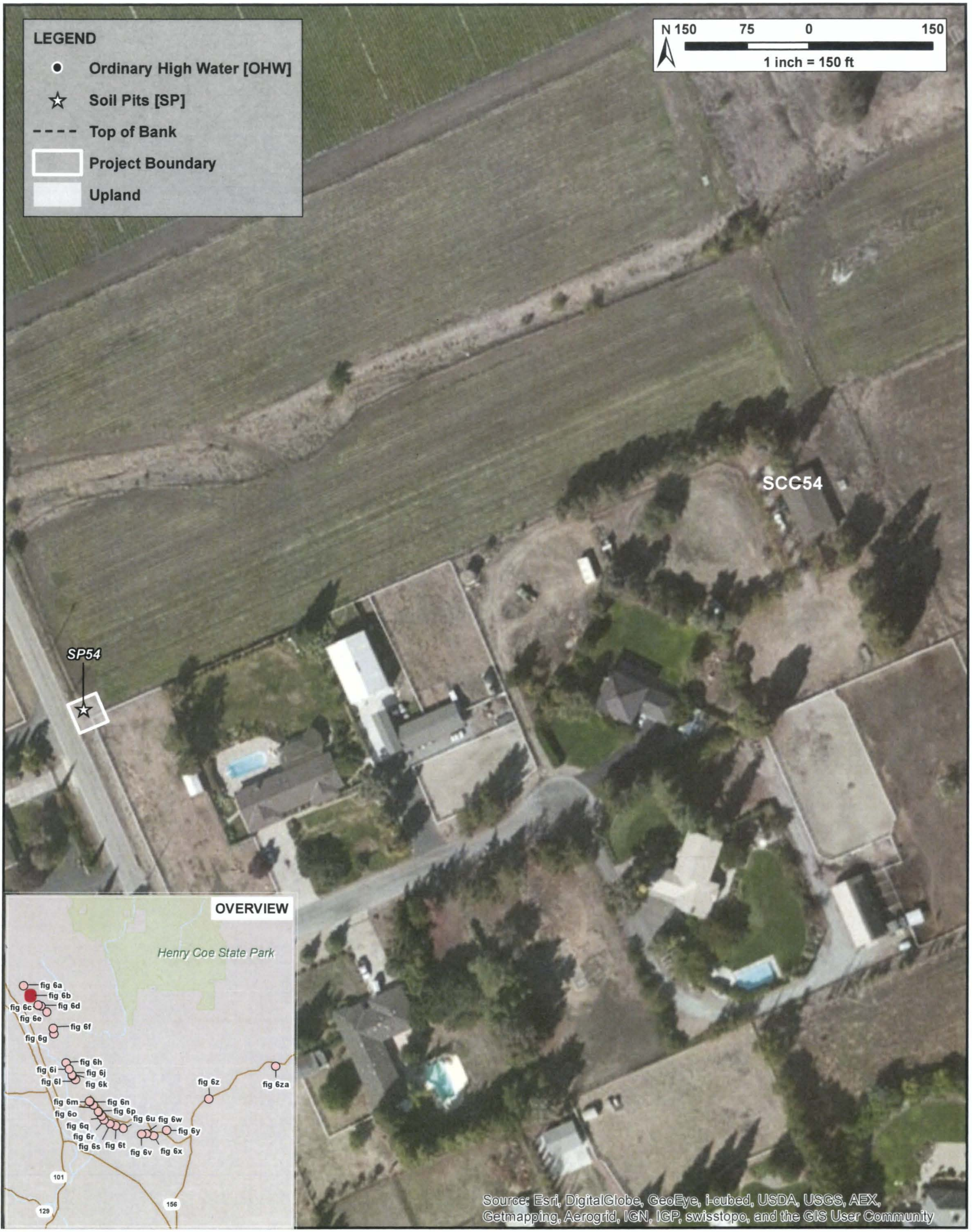
Figure 6a: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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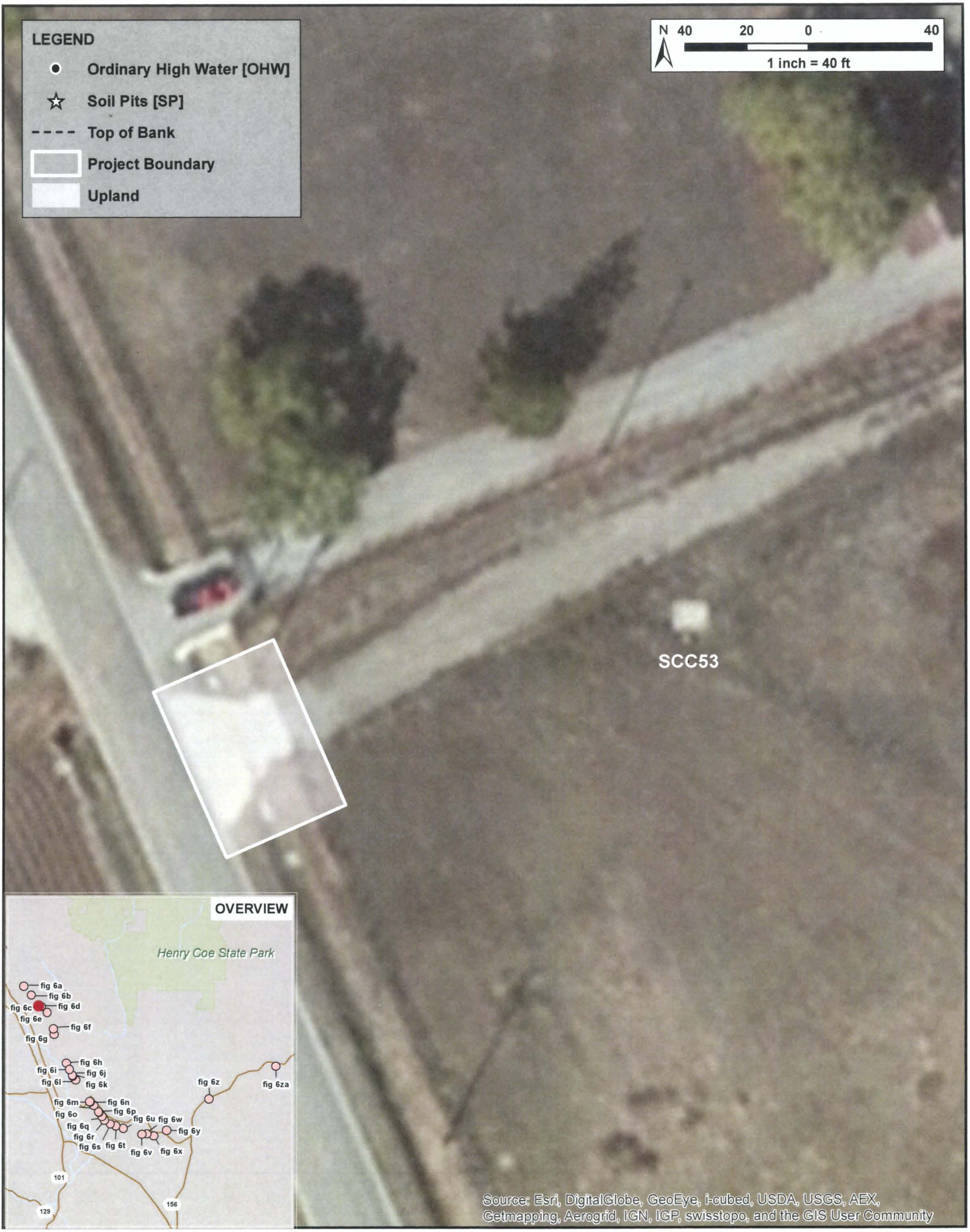
Figure 6b: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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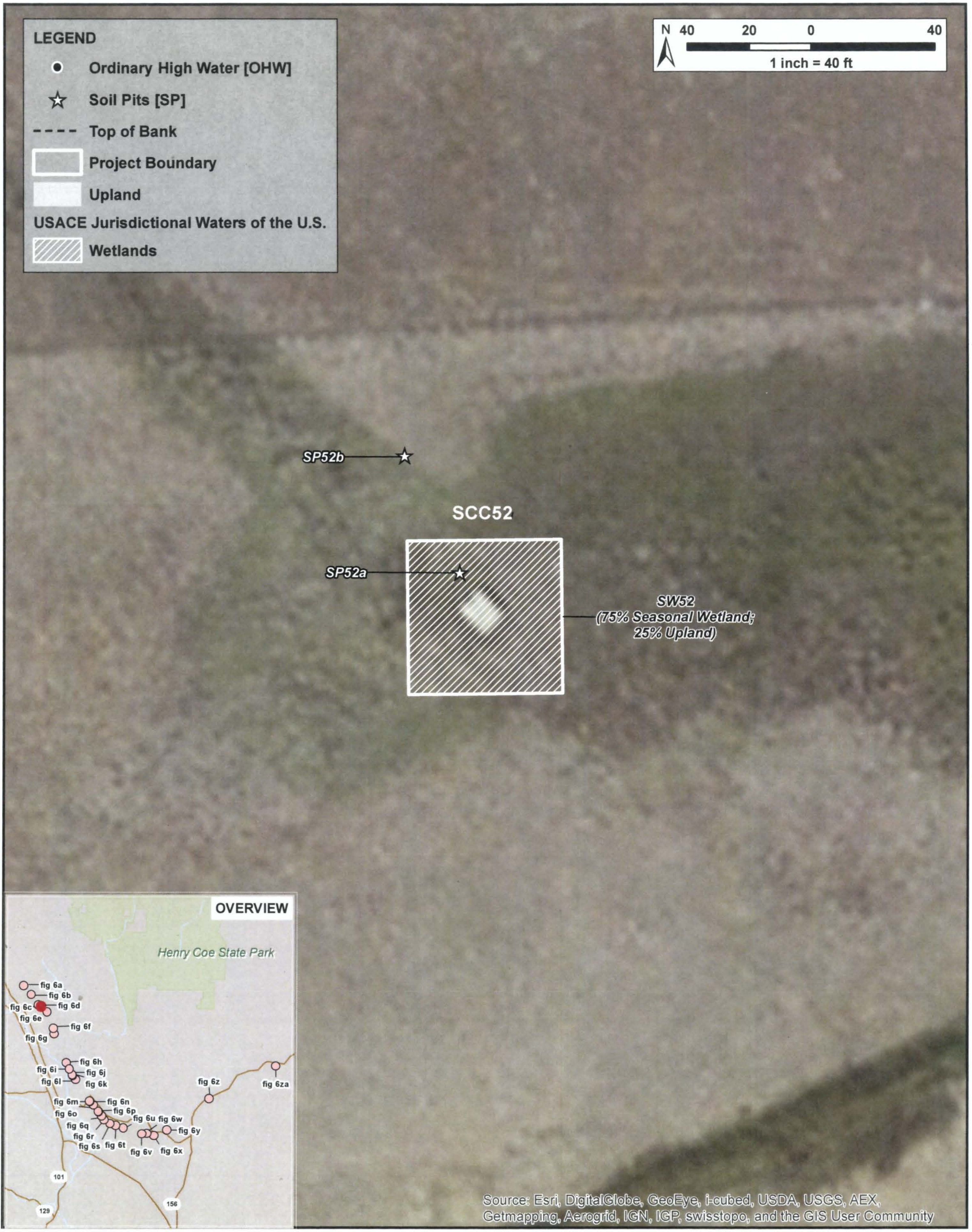
Figure 6c: USACE Jurisdictional Waters of the U.S.

SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Figure 6d: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

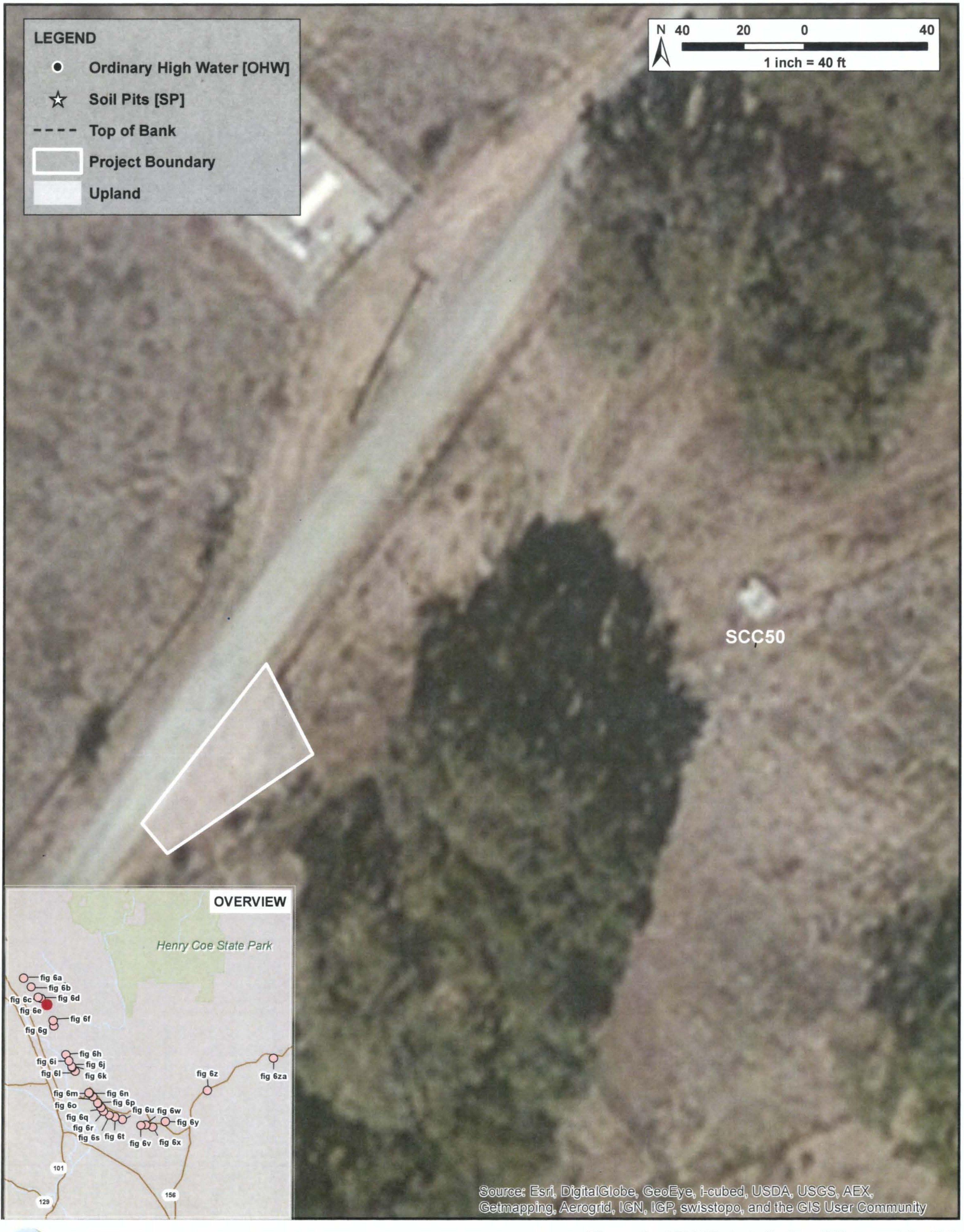

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Figure 6e: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

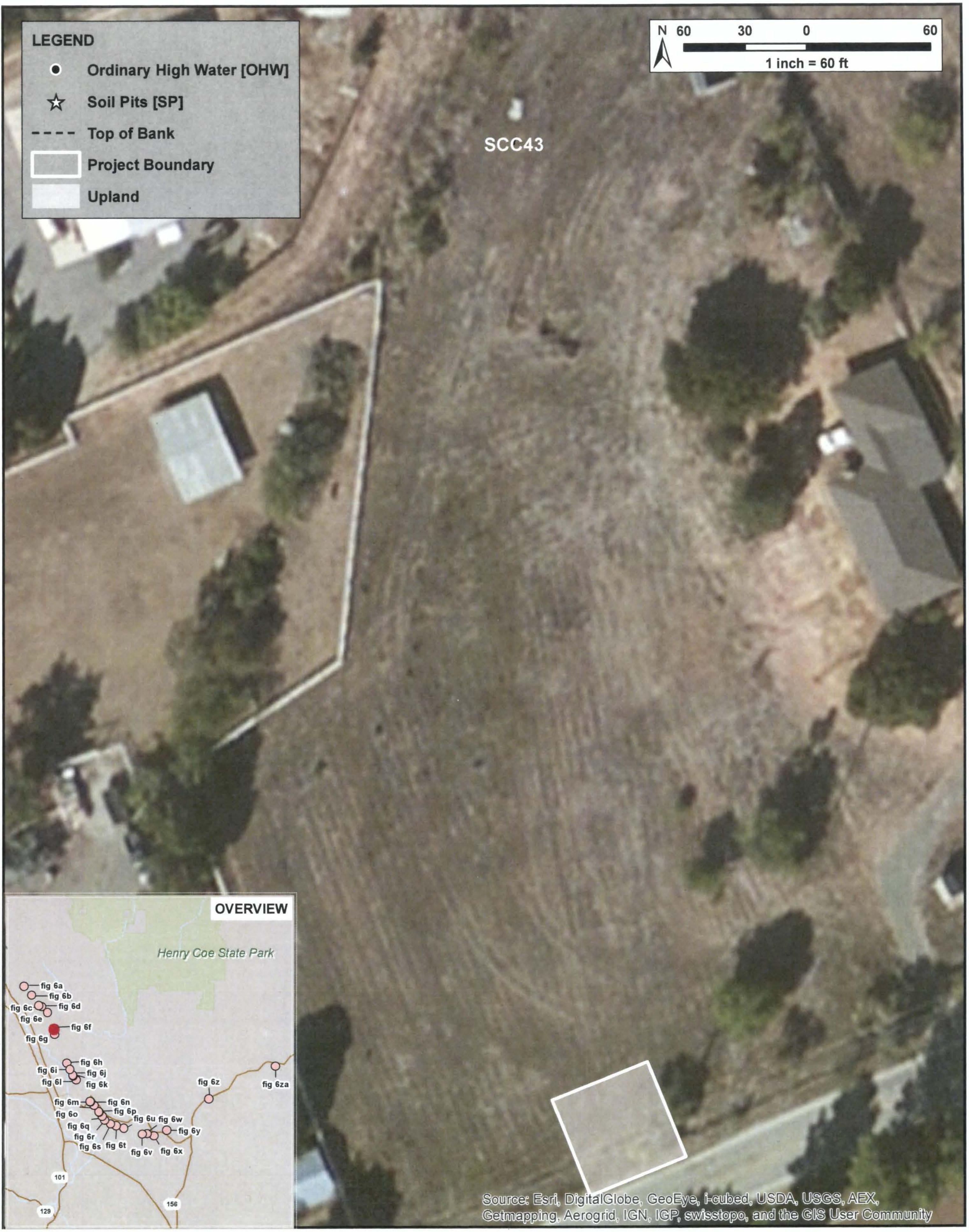

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Figure 6f: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

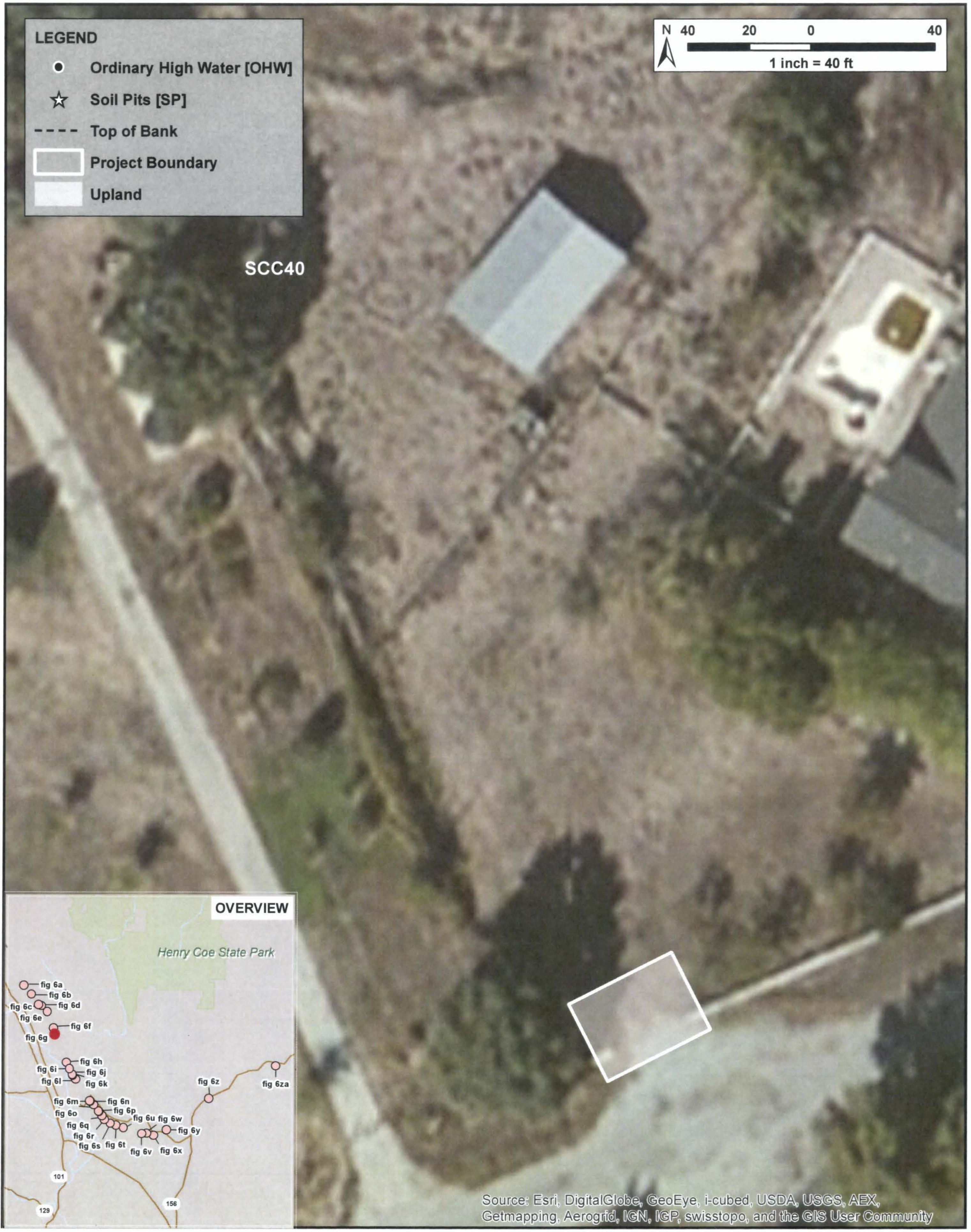

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Figure 6g: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

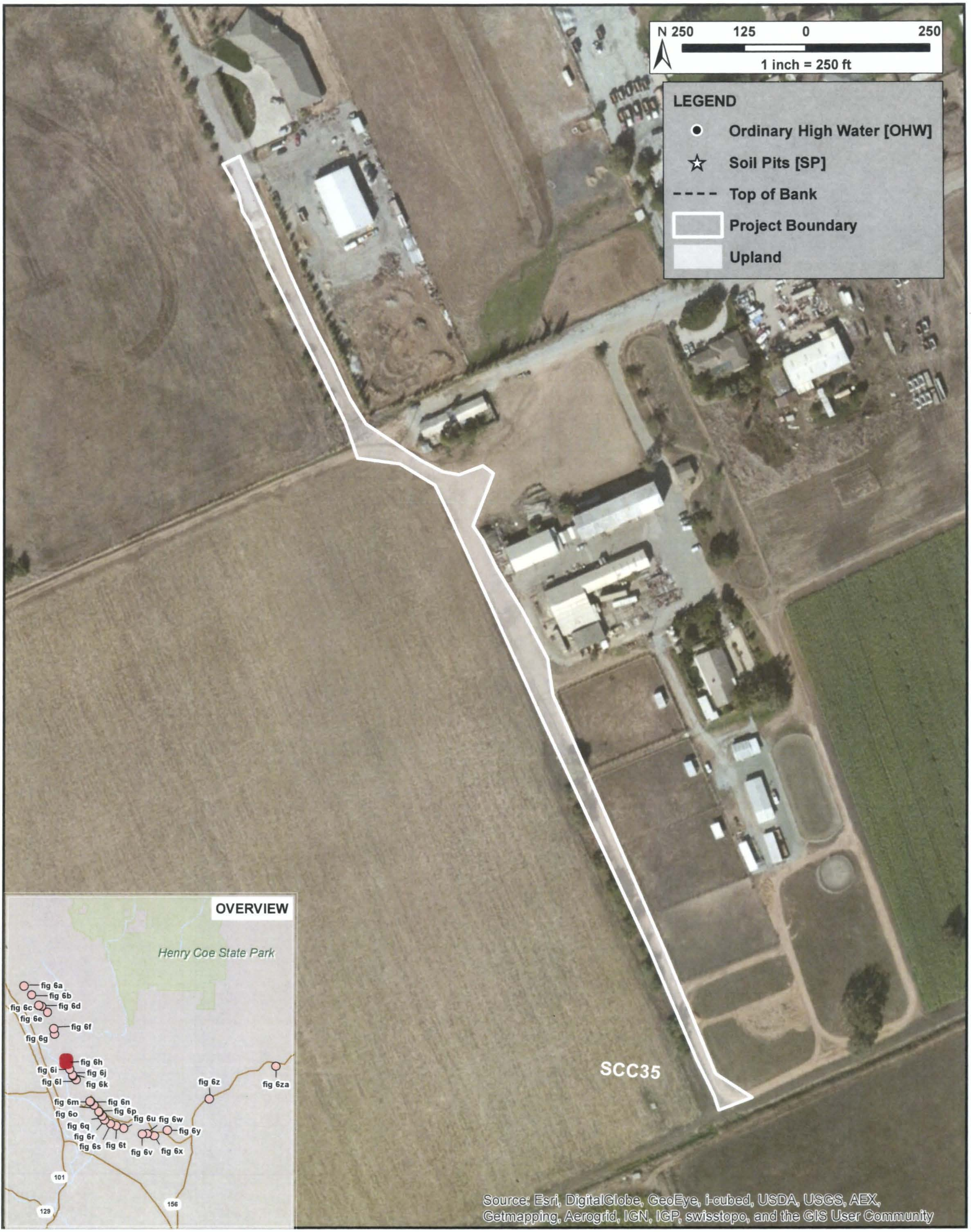

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Figure 6h: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

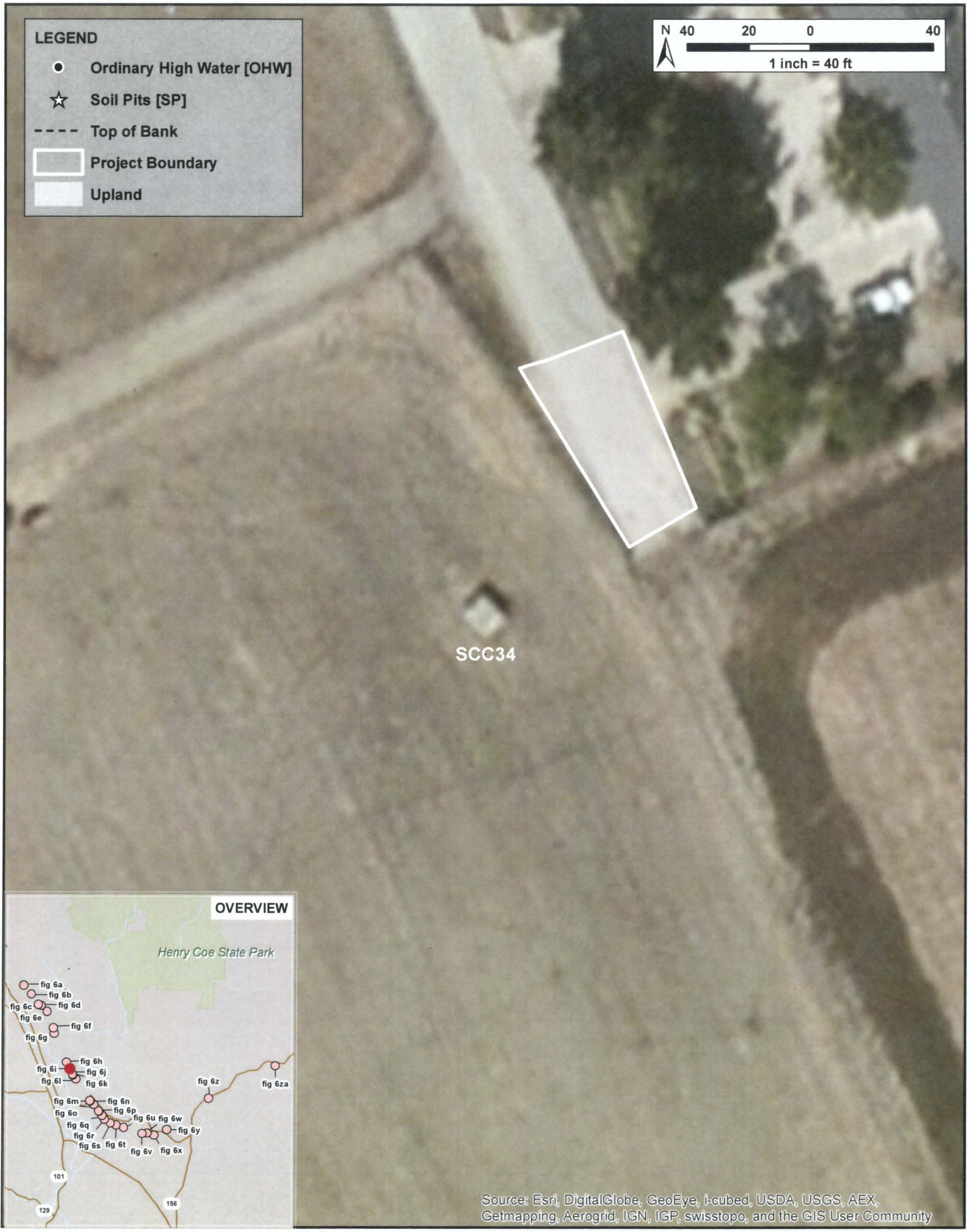

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Figure 6i: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

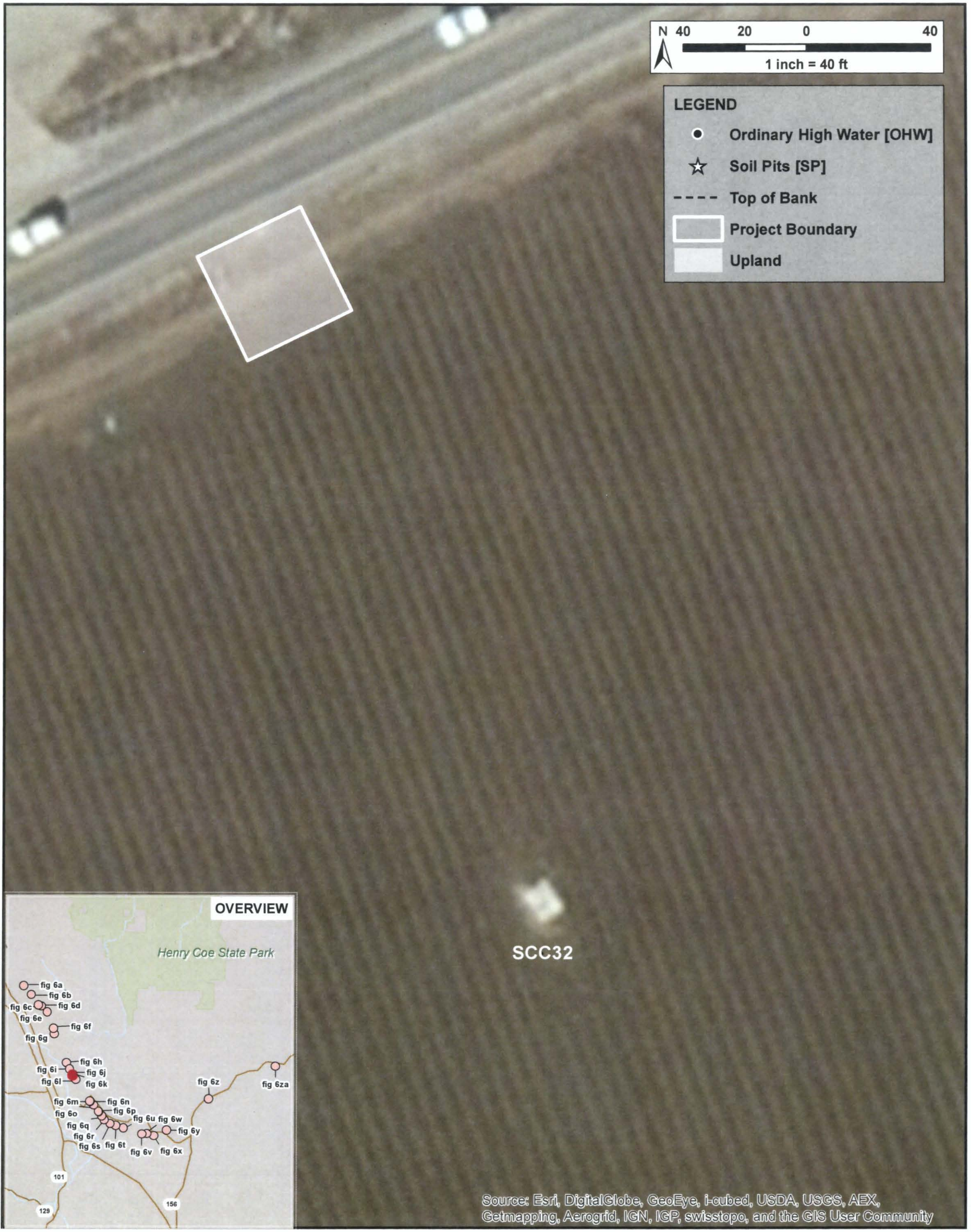

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Figure 6j: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

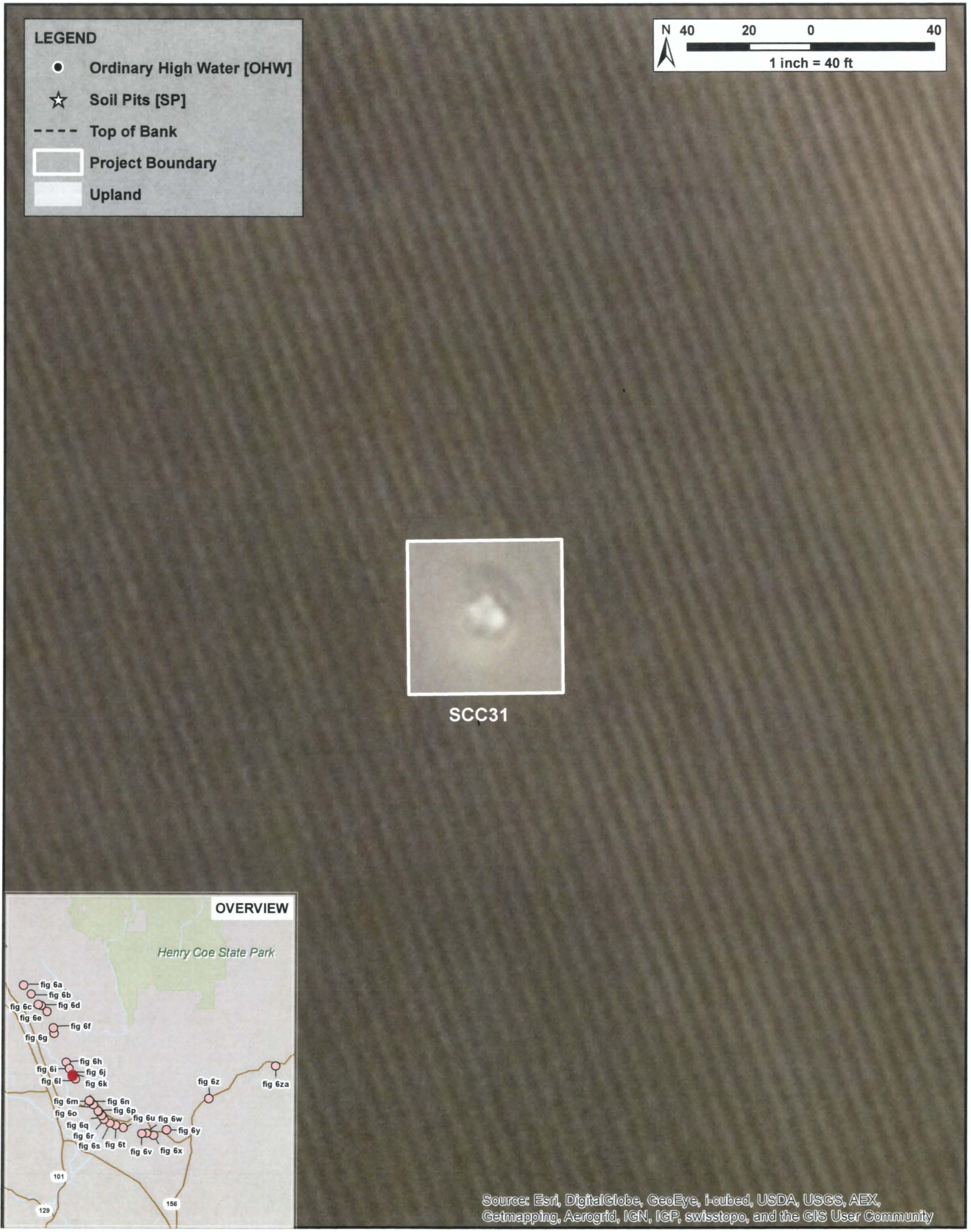

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Figure 6k: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

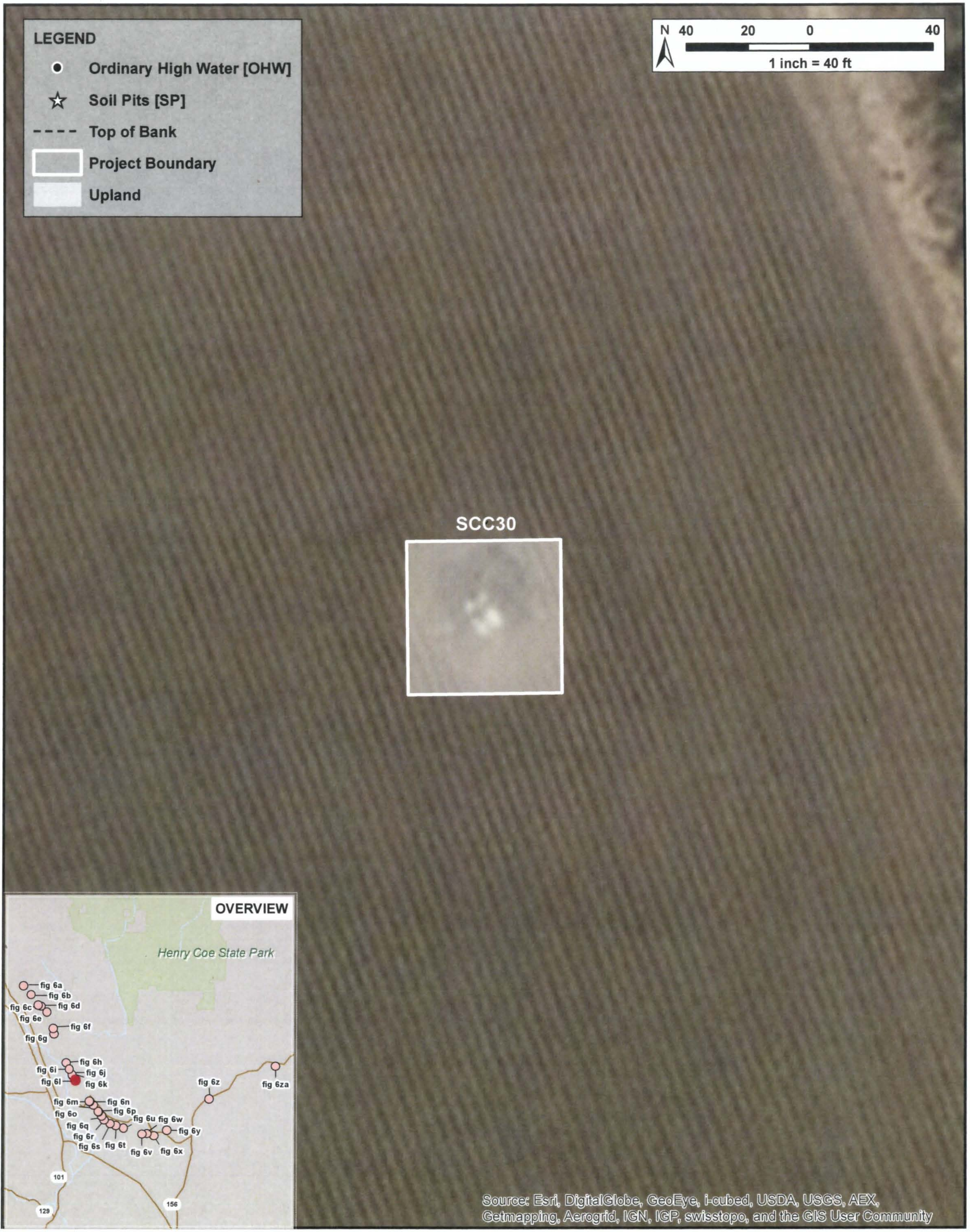

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Figure 6l: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

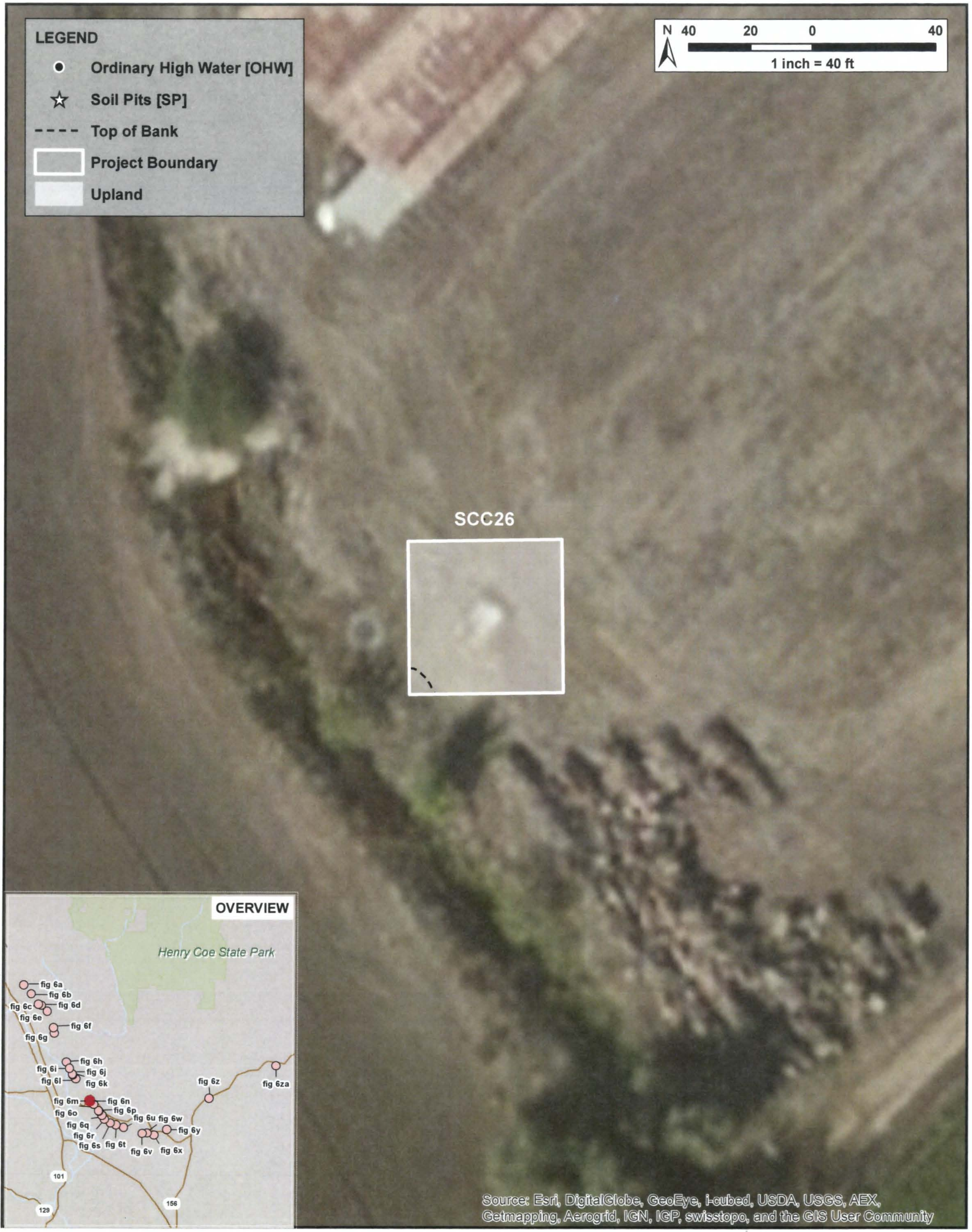

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Figure 6m: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

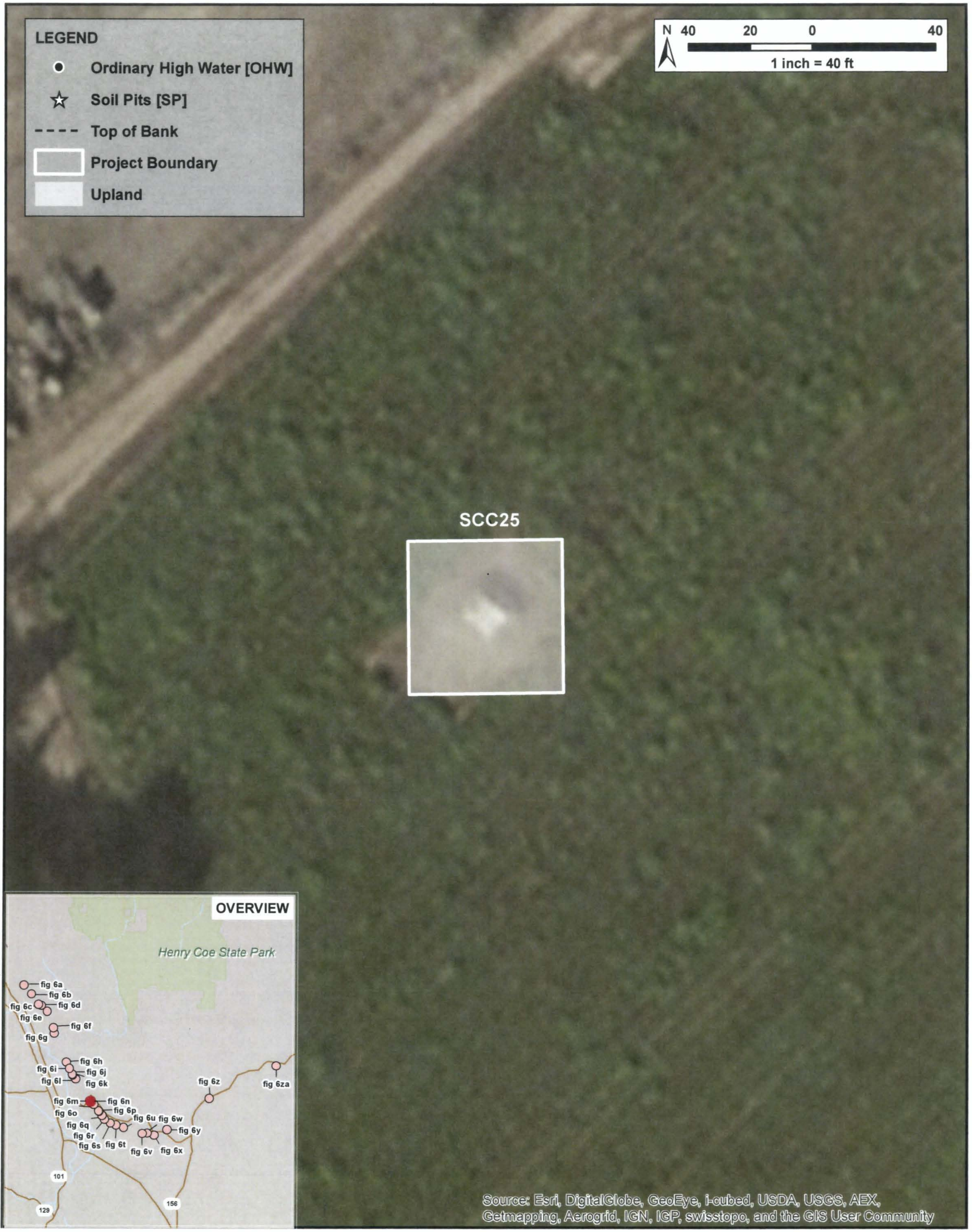

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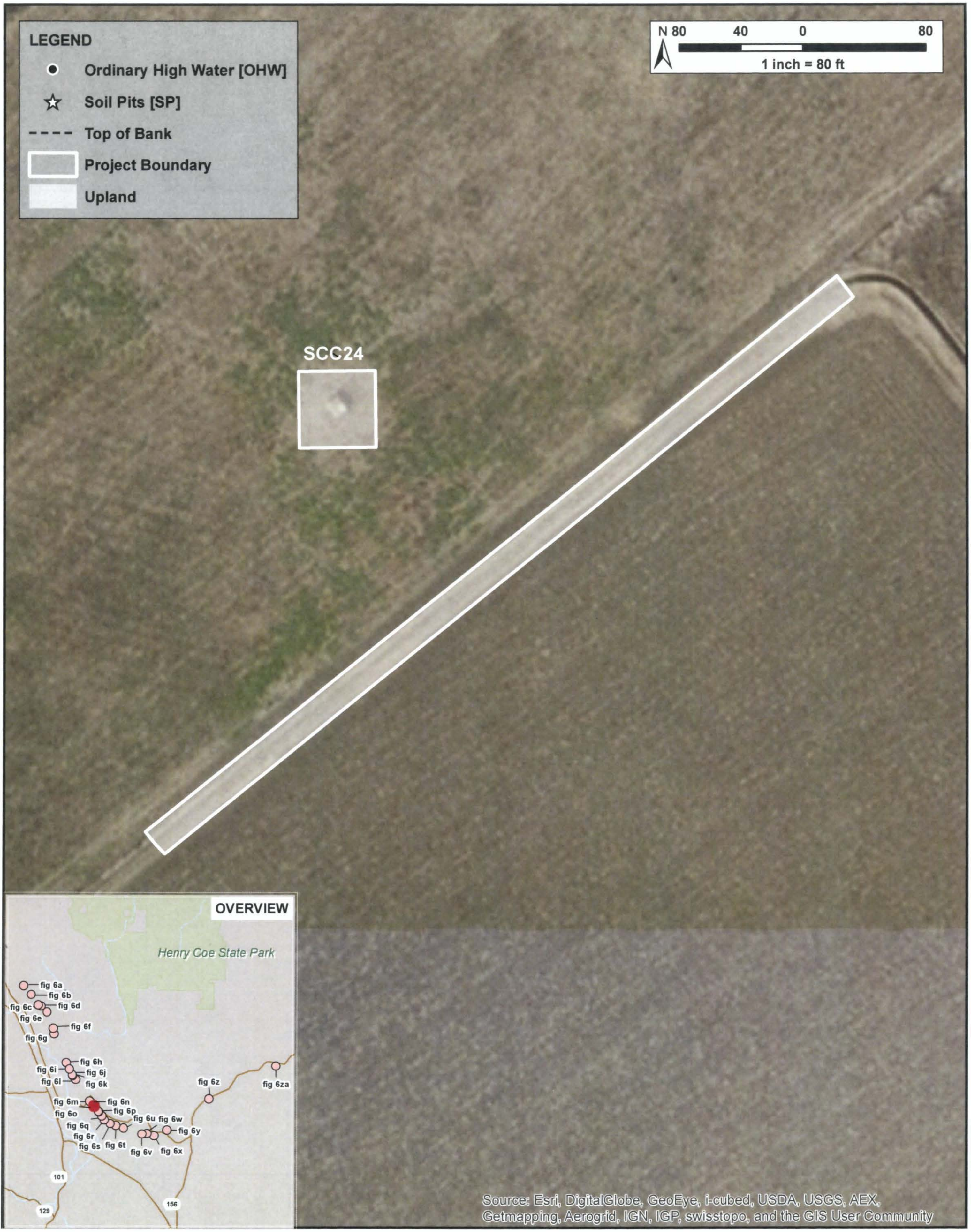
Figure 6n: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Figure 6o: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

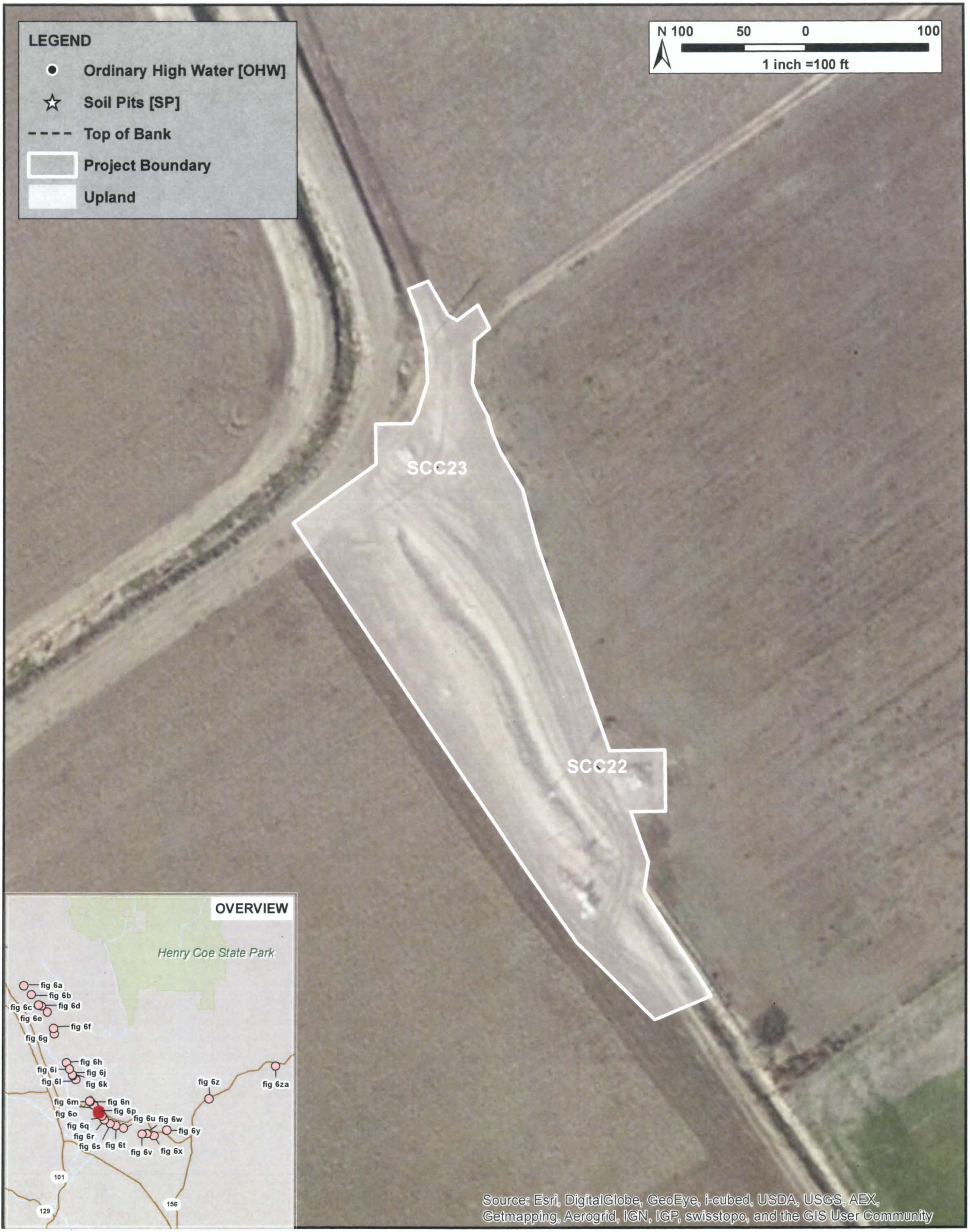

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Figure 6p: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

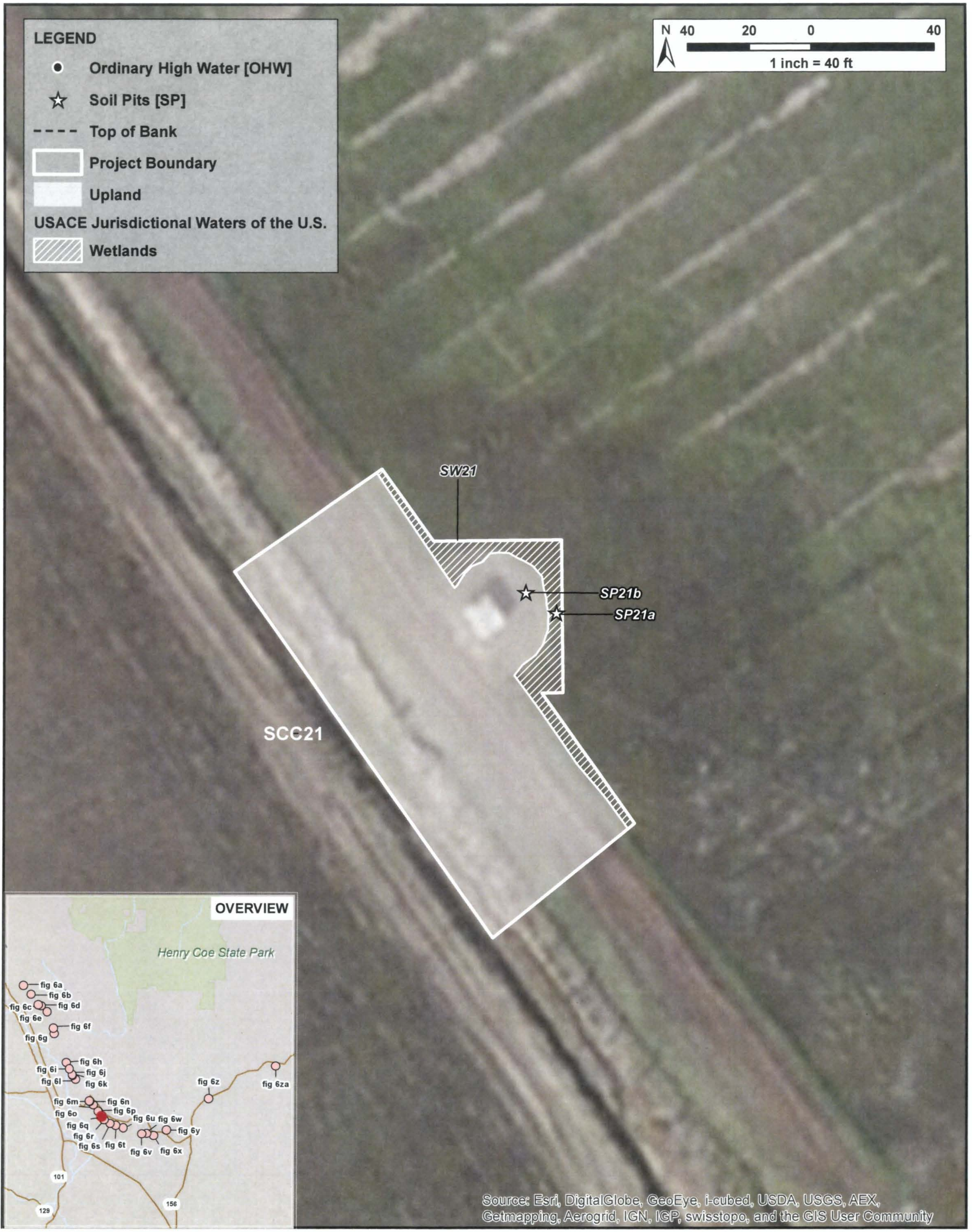

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Figure 6q: USACE Jurisdictional Waters of the U.S.

SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

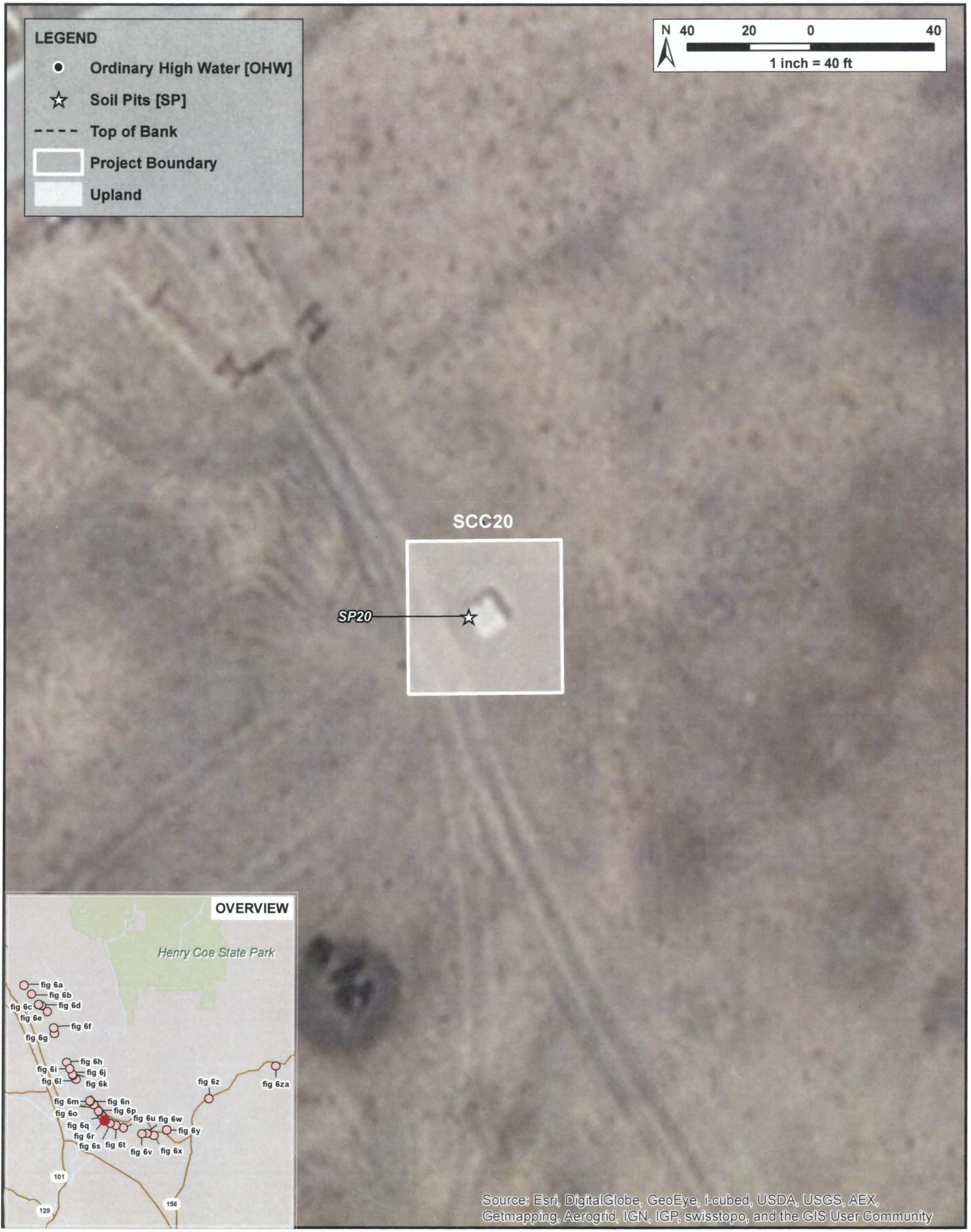

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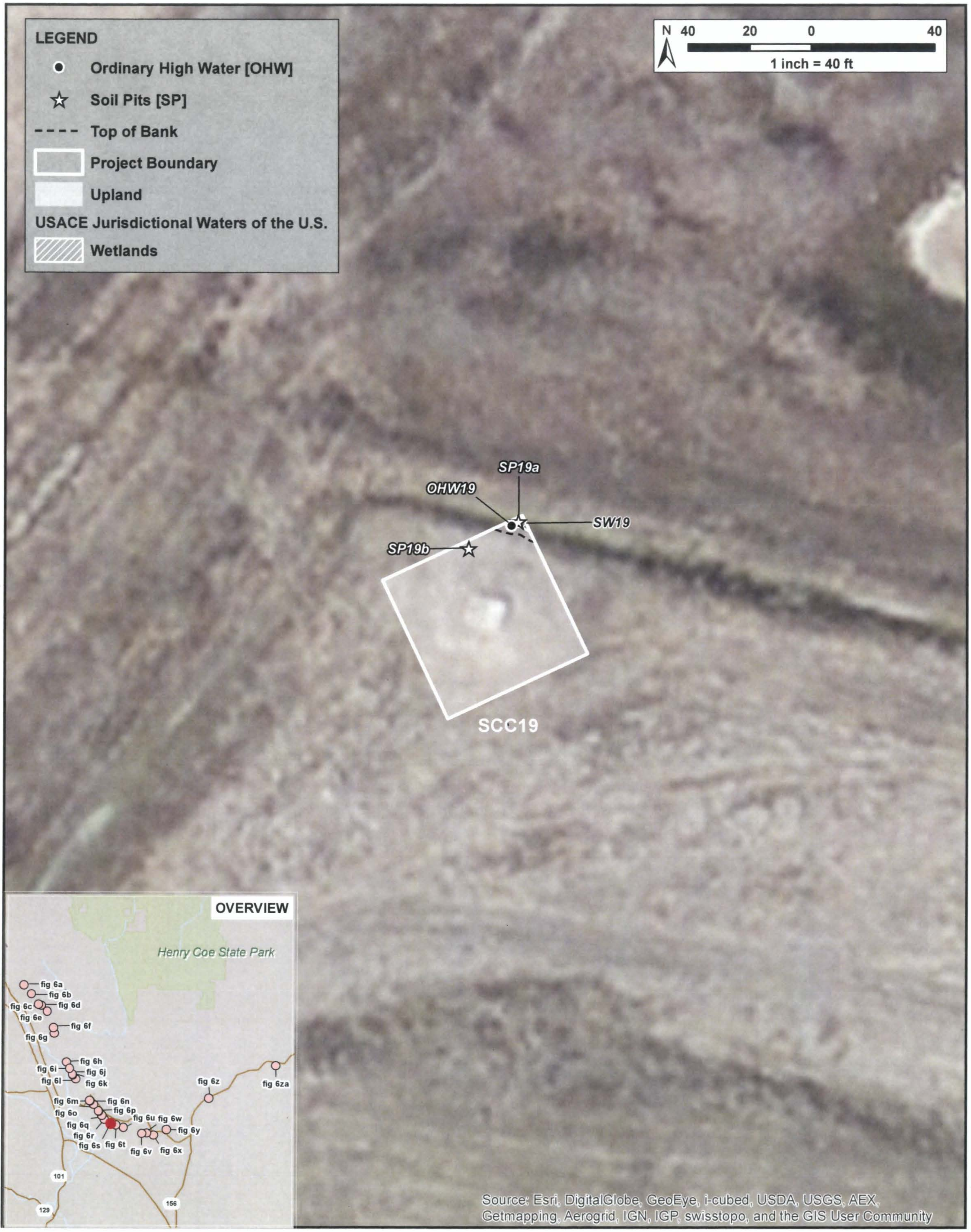
Figure 6r: USACE Jurisdictional Waters of the U.S.

SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Figure 6s: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

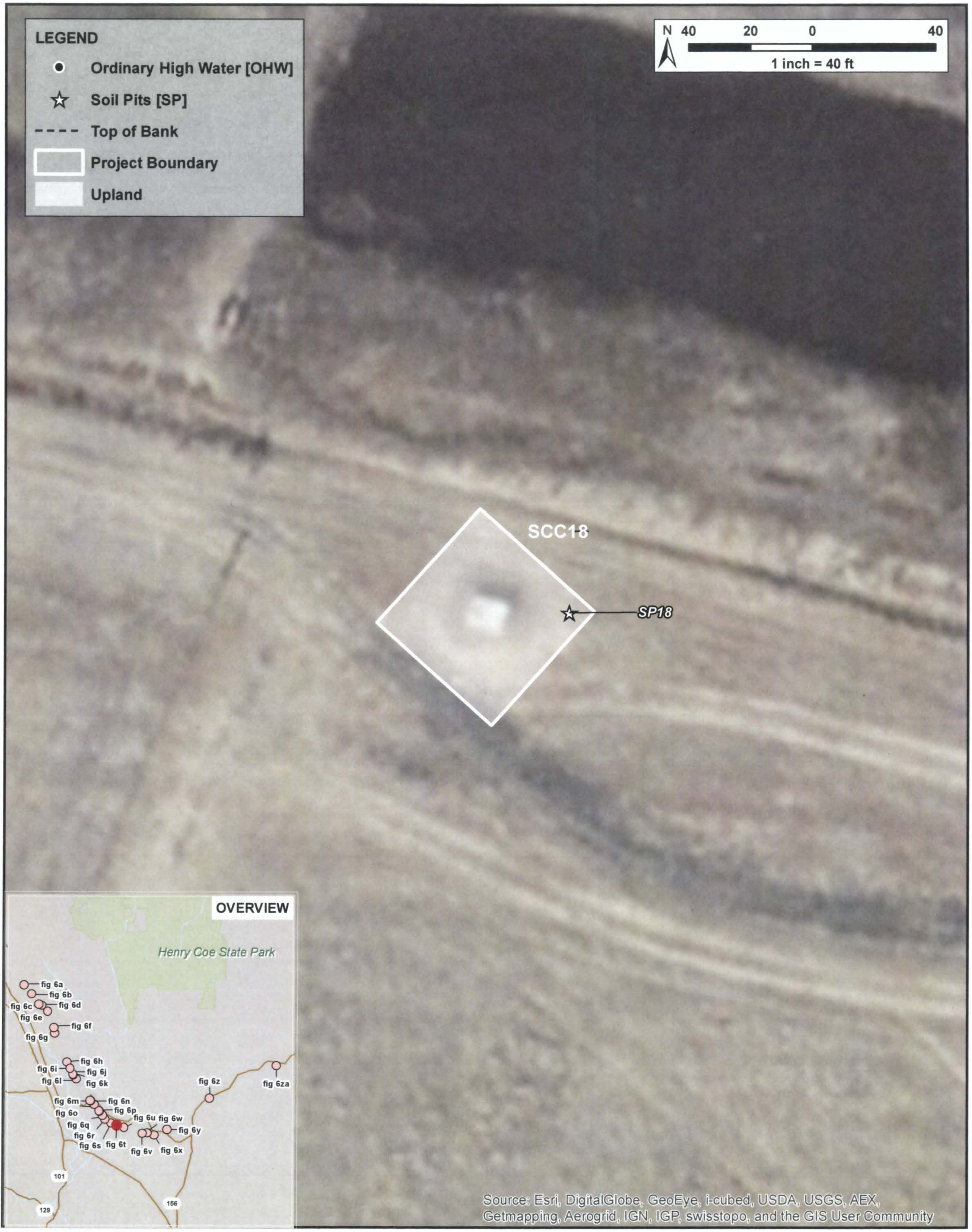

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Figure 6t: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

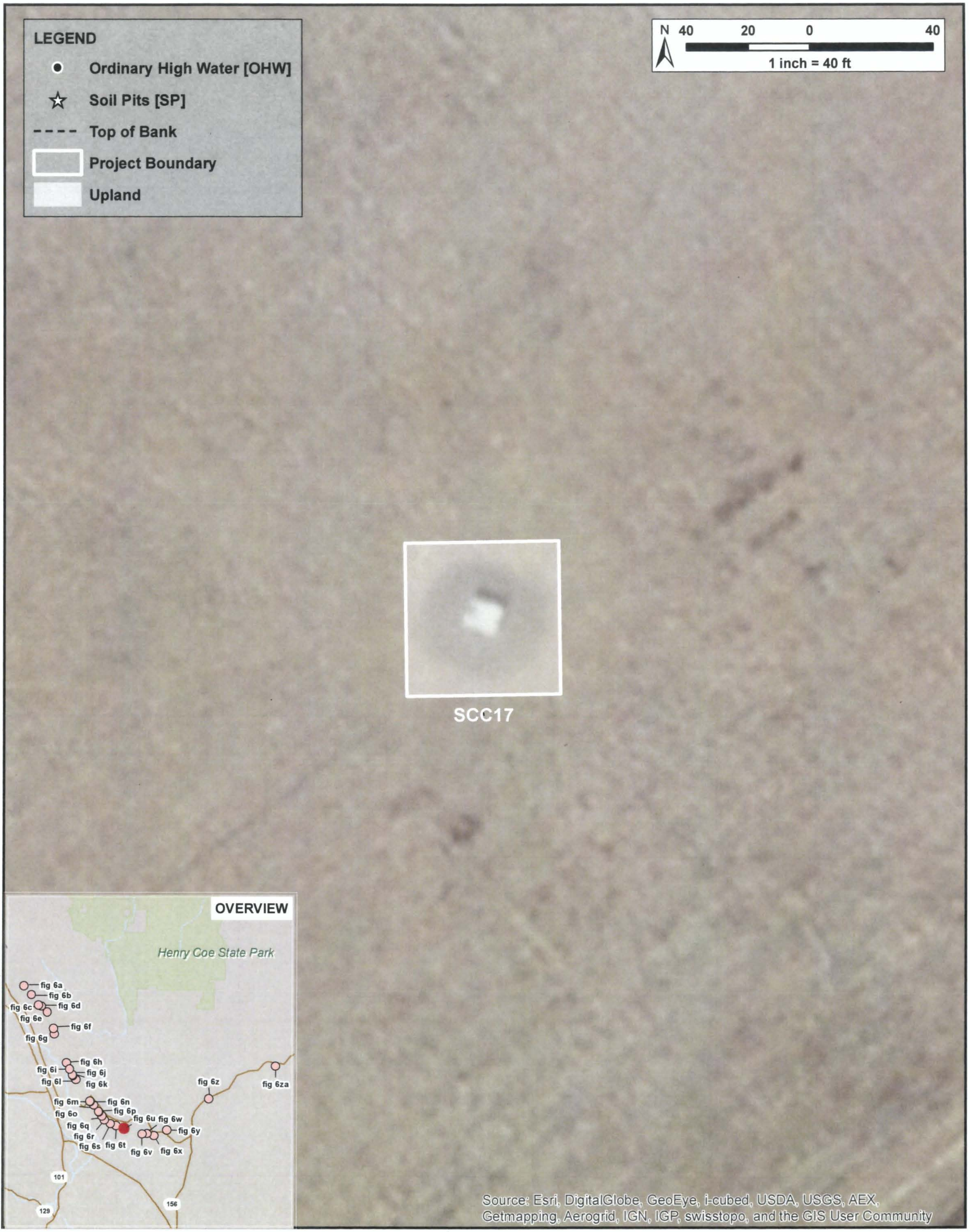

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Figure 6u: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

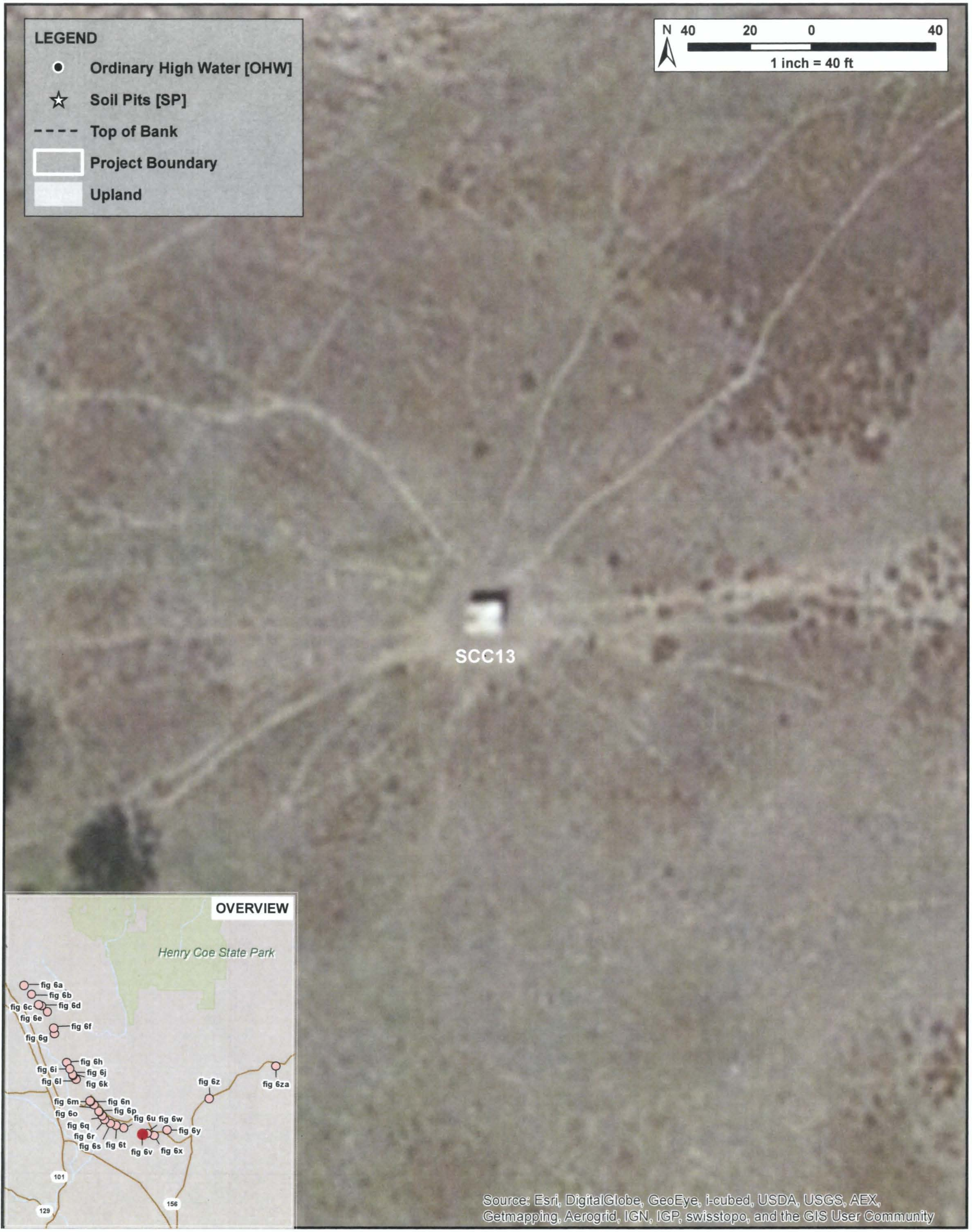

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Figure 6v: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

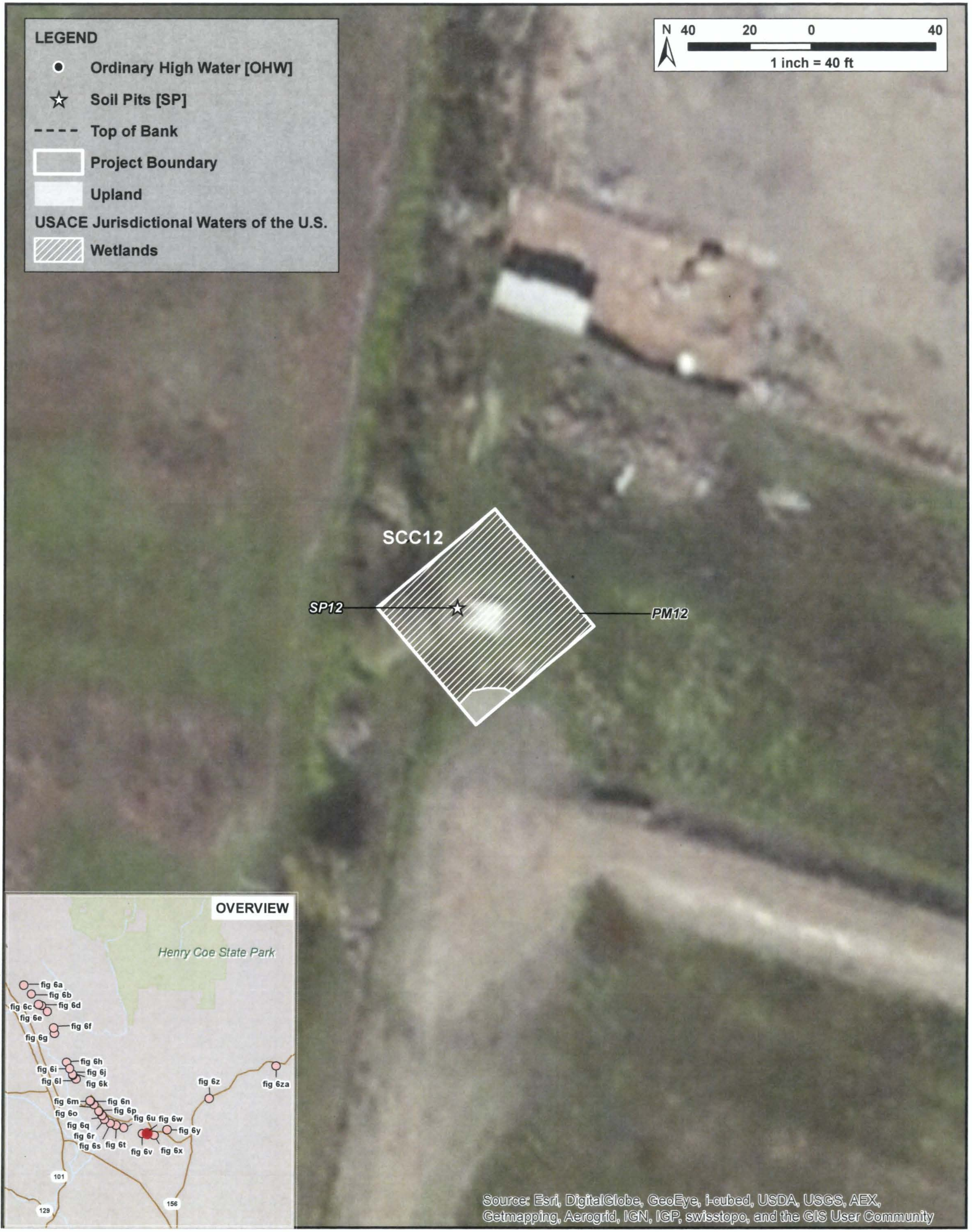

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Figure 6w: USACE Jurisdictional Waters of the U.S.

SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

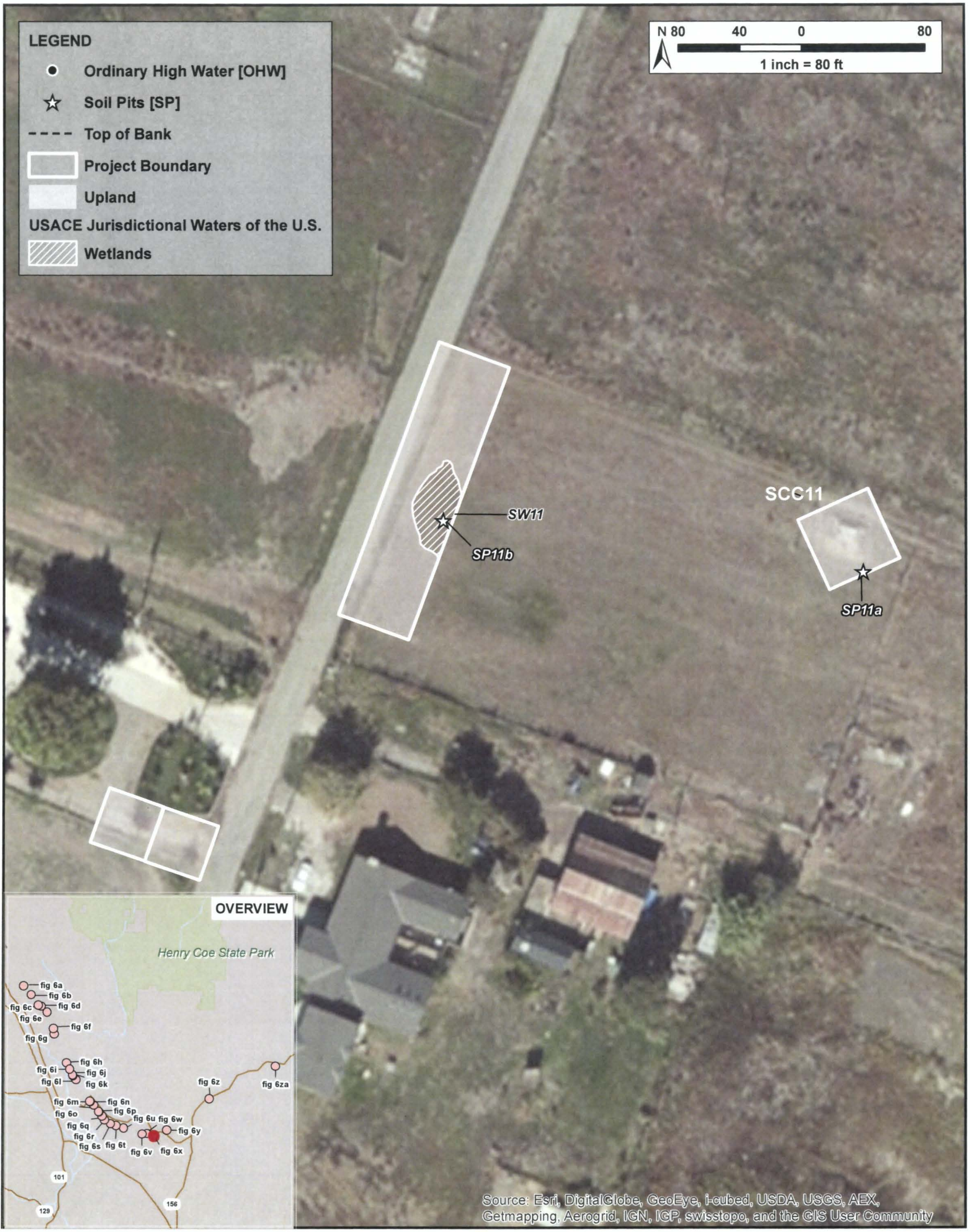

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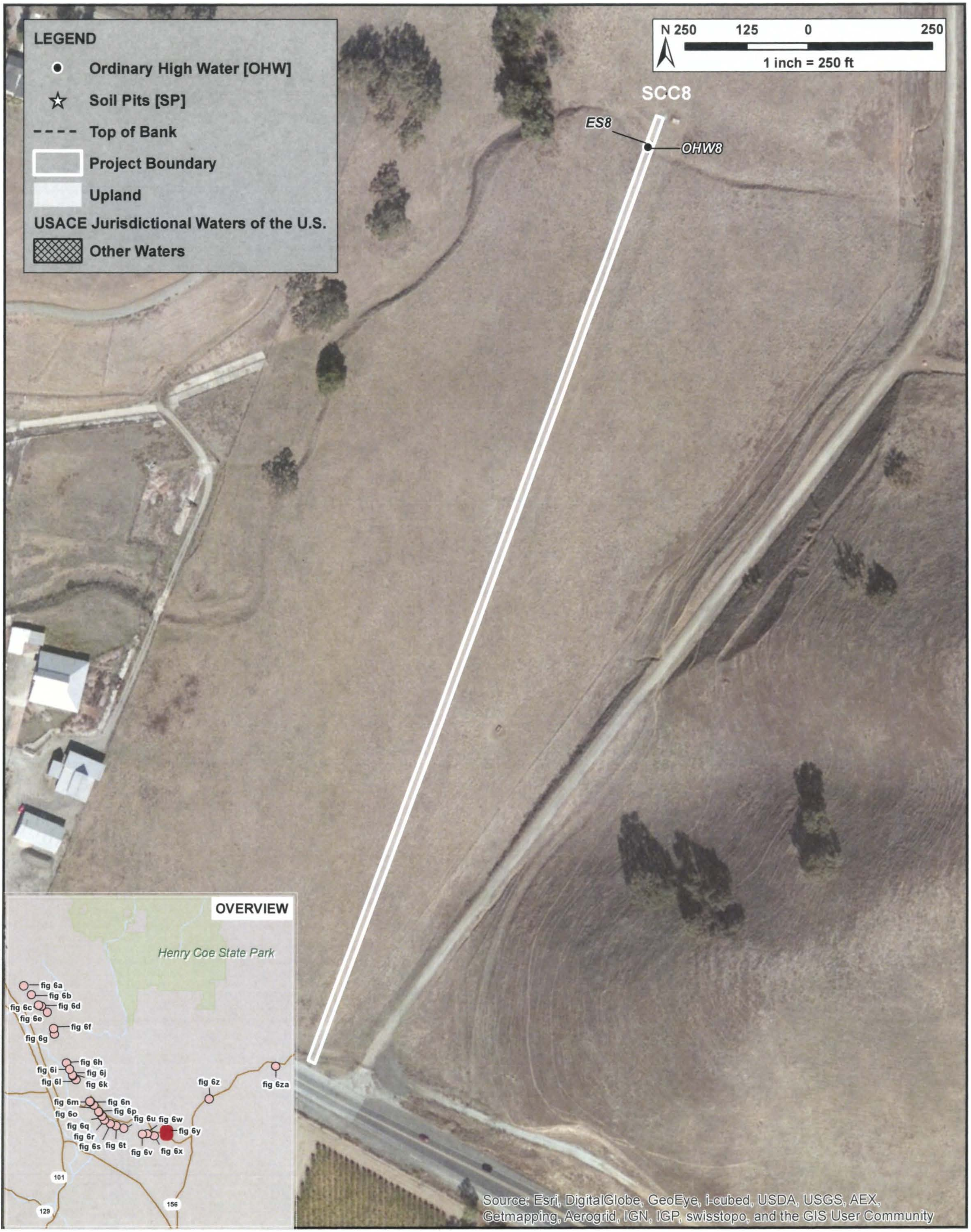
Figure 6x: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014



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N:\Projects3200\3270-02\35\Reports\ID of Waters\Fig 6 ID of Waters Map v2.mxd

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Figure 6y: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

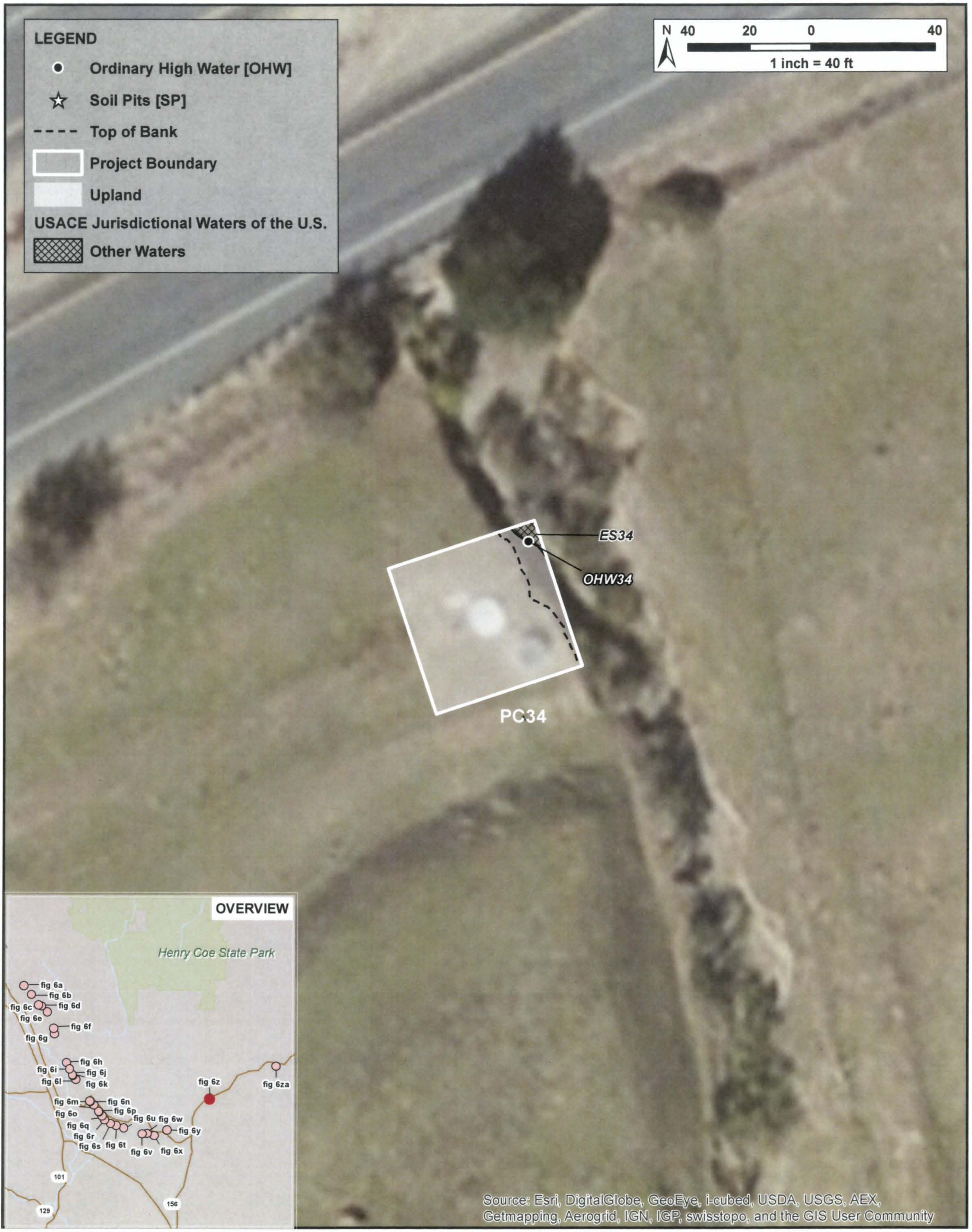

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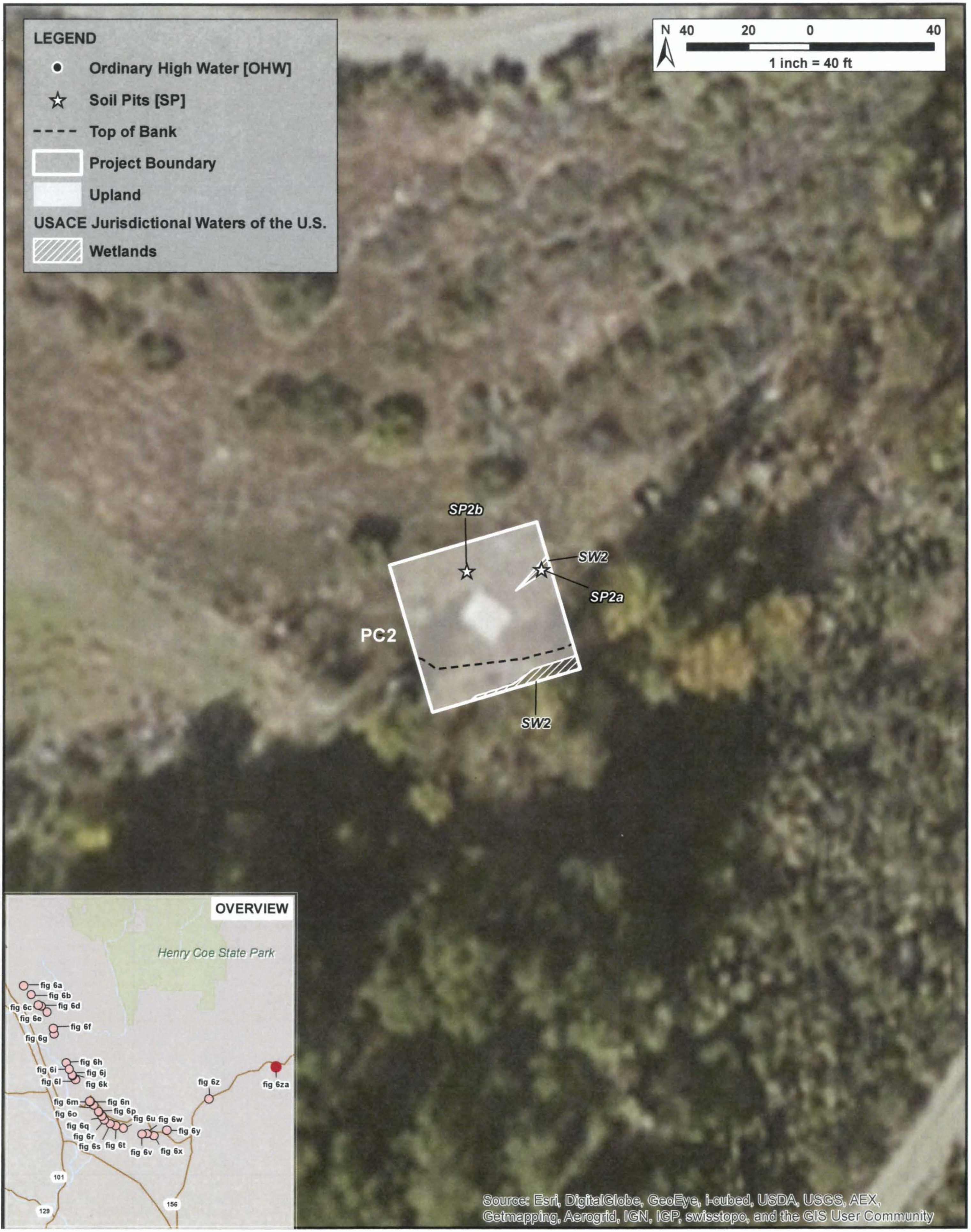
Figure 6z: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

N:\Projects3200\3270-02\35\Reports\ID of Waters\Fig 6 ID of Waters Map v2.mxd

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Figure 6za: USACE Jurisdictional Waters of the U.S.
SCVWD South County Right of Way
ID of Waters of the U.S./STATE (3270-35)
May 2014

3.1 Observations/ Rationale/ Assumptions

The results of the on-site determination of jurisdictional waters are based upon existing conditions present at the time of the surveys. Project site conditions were observed during the delineation surveys and are reported here along with pertinent background information and precipitation records.

- The on-site determination did not assume that conditions were typical for this time of year due to below-average rainfall. Although the surveys took place during the wet season, the site received approximately 4.7 inches of precipitation since October 2013, only 24 percent of normal annual rainfall (NCDC 2014 and PRISM Climate Group 2014). Approximately 2.45 inches of precipitation fell during the week prior to the March 2014 delineation surveys at the NCDC Campbell Station (GHCND:US1CASC0032), the nearest weather station with recent, daily precipitation data (NCDC 2014).

- Below-average precipitation during the 2013/2014 thus far may have contributed to a lack of observed or recent hydrology indicators in some locations, but the wetland boundaries remained clear due to the presence of hydrophytic vegetation and persistent hydric soil indicators. We delineated boundaries somewhat conservatively, under the assumption that wetland boundaries may enlarge slightly in normal years, by considering the distribution of hydric soils carefully and microtopography.

- Although the BSA was surveyed by HTH biologists during the period of seasonal water flow within the intermittent stream channels, below-average water levels allowed for the observation of OHW mark indicators such as distinct changes in vegetation cover, sediment sorting, shelving, and channel incision. Such indicators are formed during regular channel-forming storm events, such as the 2– to 5- year events.

- Three stream networks (Figures 6a, 6y, and 6z) and seven wetlands (Figures 6a, 6d, 6q, 6s, 6w, 6x, and 6za) were identified across the BSA.

- Ephemeral streams were identified by the absence of water within the channel and a lack of connection to groundwater. Ephemeral, single-thread channels were observed at SCC8, SCC57, and PC34, and include portions of Tennant Creek, an unnamed tributary that drains into Ortega Creek, and Elephant Head Creek (Figures 6a, 6y, and 6z; ES8, ES34, and EW57, Appendix D; Photographs 2, 38, and 45, Appendix E). All potentially jurisdictional features connect with the Pajaro River, a TNW that empties into Monterey Bay. No perennial streams were identified within the BSA.

- One perennial marsh was identified at SCC12 by the perennial hydrophyte community consisting of cattails (*Typha* sp., OBL) and smartweed (*Persicaria* sp., FACW/OBL), the presence of a strong hydrogen-sulfide odor, and because surface water, a high water table, and saturation were observed at this location (Figure 6w; SP12, Appendix C; Photograph 5, Appendix E).

- Access to SCC12 vault was restricted as a result of deep water and mud, and fencing constructed by landowners over the course of the survey period. This prevented HTH biologists from revisiting this location to identify the species of plant genera that did not have the reproductive structures necessary for identification present during the March 2014 survey period. Dominance of plants in genera with only OBL or FACW species found in the region of the BSA, in addition to strong hydric soil and hydrology indicators, allowed for the determination of this area as a perennial marsh. Uplands at near the SCC12 vault were restricted to a berm, approximately 5 feet high.

- Seasonal wetlands were identified at SCC11, SCC19, SCC21, SCC52, SCC57, and PC2. Seasonal wetlands at SCC19 and SCC57 were below the OHW marks of the Pajaro River and Tennant Creek, respectively (Figures 6a and 6s; SP19a and SP57a, Appendix C; Photographs 4, 12, 30-32, and 39, Appendix E). The seasonal wetlands at PC2 were in the active floodplain of Pacheco Creek, just above the top of bank, and on a low terrace above the OHW mark (Figures 6za; SP2a, Appendix C; Photographs 9, and 40-43, Appendix E). Other seasonal wetlands (SCC11, SCC21, and SCC52) were situated on flat, poorly drained, low-lying agricultural land and meadows (Figures 6d, 6q, and 6x; SP11b, SP21a, and SP52a, Appendix C). These areas are without standing water for much of the year, but a high water table in years with normal rainfall would allow the soil to remain saturated.

- The BSA at SCC52 is a mosaic of wetland and upland patches (Photograph 30, Appendix E). Microtopographic variation in this low-lying meadow has contributed to the colonization of hydrophytic species, allowed for the processes of reduction and translocation to remove or transform iron in the soil, and the collect surface water over much portions of the area (SP52a, Appendix C; Photograph 31-32, Appendix E). This site is comprised of approximately 75 percent wetland and 25 percent upland. These percentages were taken into account when calculating the total wetland and upland acreages across the BSA.

- Non-jurisdictional waters (roadside and agricultural ditches) are included in the upland habitat type and acreage. These features were observed at SCC21, SCC24, SCC35, SCC53, and SCC54 (Photographs 13, 15, 16, and 26, Appendix E). Drainage ditches did not have OHW mark indicators, and are artificial features that do not replace any natural stream channels or drainages. In addition, they are currently managed to keep vegetation from establishing in the channels. Non-jurisdictional waters did not support a significant hydrophytic community and only carry surface runoff during and immediately rainfall events.

3.2 Areas Meeting the Regulatory Definition of Jurisdictional Waters

3.2.1 Identification of Section 404 Potential Jurisdictional Wetlands

For purposes of this report, and as required by the USACE mapping requirements, wetland features have been divided into several categories, including coastal and valley freshwater march and seasonal wetlands. The figures (i.e. 6a through 6za) have these categories identified as "wetlands."

Coastal and Valley Freshwater Marsh. Within the BSA, approximately 1,572 square feet of coastal and valley freshwater marsh (perennial marsh wetland) was identified. One of sixteen soil pits occurred within this habitat, and was located in a low-lying area utilized by cattle at SCC12 (Figure 6w; SP12, Appendix C; Photograph 5, Appendix E). The marsh surrounds the vault at SCC12, and is part of a larger wetland system that extends to the north and east. Vegetation in this habitat is dominated by perennial aquatic emergent vegetation, such as cattails and smartweed. At the time of the field survey, the wetland contained approximately 4-12 inches of surface water over approximately 60 percent of the wetland (Photograph 5, Appendix E). The high water table was at a depth of 2 inches, and the entire soil profile was saturated. The substrate of the wetland is clay with prominent redox concentrations, overlain by a 1-inch layer of dark colored clay with high organic material content (SP12, Appendix C).

Seasonal Wetland. Within the BSA, approximately 2,723 square feet of seasonal wetlands occur (Appendix F). Six of sixteen soil pits were located within seasonal wetlands (SP2a, SP11b, SP19a, SP21a, SP52a, and SP57a, Appendix C). At SCC11, the seasonal wetland was situated on low-lying land near rural residences (Figure 6x; SP11b, Appendix C; Photograph 4, Appendix E). While this area was not being used for agricultural purposes during the time of the survey, aerial imagery from May 2012 shows that the BSA at this location was disked or tilled (Microsoft 2013). In addition, evidence of fill soil placement interspersed around the BSA at SCC11 was observed during the survey. This seasonal wetland was dominated by pickleweed (*Salicornia* sp., OBL), and the substrate was clay loam with prominent redox concentrations in the soil matrix and along pore linings. While no primary hydrology indicators were observed, vegetation at SCC11 passed the FAC-neutral test (1:1) and saturation is visible on aerial images from October 2007, September 2009, and September 2011.

The seasonal wetland at SCC19 was below the OHW marks of an ephemeral section of the Pajaro River along a reach that has likely been straightened (Figure 6s; SP19a, Appendix C; SW19, Appendix D; Photograph 9, Appendix E). This wetland was dominated by saltgrass (*Distichlis spicata*, FAC), and the substrate was clay with distinct redox concentrations. While no primary hydrology indicators were observed, the vegetation was matted in one direction (indicative of drainage patterns) and saturation is visible on aerial imagery from December 2005, August 2006, September 2009, and February 2010.

The seasonal wetland at SCC21 was situated on low-lying agricultural or ranch land, although the area was not planted with crops at the time of the survey and no cattle were observed (Figure 6q; SP21a, Appendix C;

Photograph 12, Appendix E). This wetland was dominated by Italian ryegrass (*Lolium perenne*, FAC), and the substrate was clay loam with prominent redox concentrations. Two inches of stagnant surface water was observed in low-lying areas in-between hummocks, and covered approximately 10 percent of the wetland at the time of the survey.

At SCC52, the BSA is a mosaic of approximately 75 percent seasonal wetland, and 25 percent upland. This location is in a low-lying meadow near Coyote Lake – Harvey Bear County Park, and is in the active floodplain of San Martin Creek (Figure 6d; SP2a, Appendix C; Photographs 30-32, Appendix E). Seasonal wetland patches were in concave depressions, and were dominated by seaside barley (*Hordeum marinum*, FAC), and iris-leaved rush (*Juncus xiphioides*, OBL). The substrate was silty clay loam, and the processes of reduction and translocation have removed or transformed iron, creating a soil color of low chroma and high value. This feature, in concert with the presence of prominent redox concentrations along pore linings is indicative of a depleted soil matrix (SP2a, Appendix C). Surface water covered approximately 10 percent of the wetland patches, and was recorded at a depth of 2 inches. The high water table was observed at 6 inches in depth, and the entire soil profile was saturated.

At SCC57, the seasonal wetland was below the OHW marks of an ephemeral section of Tennant Creek, adjacent to rural residences and greenhouses (Figure 6a; SP57a, Appendix C; Photograph 39, Appendix E). The herbaceous layer of this wetland was dominated by spearmint (*Mentha spicata*, OBL), and the overstory was dominated by Northern California walnut (*Juglans hindsii*, FAC) and camphora tree (*Cinnamomum camphora*, UPL). The substrate was silty clay loam with prominent redox concentrations. Water stained leaves of previous year's vegetation were observed at this location, along with drainage patterns, identified by vegetation matted in one direction.

Two distinct seasonal wetlands were identified at PC2 in the active floodplain of Pacheco Creek (Figure 6za; SP2a, Appendix C; Photographs 40-43, Appendix E). The wetland patch where SP2a was dug (Appendix C) was situated just above the top of bank in a concave depression. The herbaceous layer was dominated by bird's foot trefoil (*Lotus corniculatus*, FAC), the shrub layer was dominated by mulefat (*Baccharis salicifolia*, FAC), and the overstory was dominated by California sycamore (*Platanus racemosa*, FAC). This area was underlain by loam, but a layer of cobble prevented sampling at a depth greater than 6 inches. At the time of the survey, 2-inch deep stagnant, surface water covered approximately 10 percent of this wetland, and the entire soil profile was saturated. The second wetland was a monoculture of naked sedge (*Carex nudata*, OBL), and was situated on a low terrace above the OHW mark of Pacheco Creek. Soil sampling was prevented at this location by the cobble substrate. A primary hydrology indicator observed at this location included water-stained leaves at the base of naked sedge plants.

3.2.2 Identification of Section 404 Potential Jurisdictional Other Waters

Other waters identified within the BSA include ephemeral streams at SCC8, SCC57, and PC34 (Figures 6a, 6y, 6z; ES8, ES34, ES57, Appendix D; Photographs 2, 38, 45, Appendix E). These features include portions of Tennant Creek, an unnamed tributary that drains into Ortega Creek, and Elephant Head Creek, all of which drain into the Pajaro River, a TNW that empties into Monterey Bay. These potential jurisdictional other waters are discussed below. Other waters have been categorized as "ephemeral stream" and are reported as "other waters" on Figures 6a through 6za.

Ephemeral Stream. Within the BSA, ephemeral stream habitat covers 162 square feet (Appendix F). Two of the sixteen soil pits were located in seasonal wetlands that were situated below the OHW marks of ephemeral streams (SP19a and SP57a, Appendix C). Three sample points to identify the OHW marks of other waters were recorded (ES8, ES34, ES57, Appendix D). Flowing water was not observed at the time of the delineation survey, and the soil was dry to slightly saturated as a result of the rains during the week prior to the survey. The active floodplain was not observed at any of these streams, and upper terraces are expected only to receive flows during 100-year flood events.

The streambed of the unnamed tributary at SCC8 was vegetated with upland herbaceous plant species such as wild oats (*Avena* sp., UPL) and was underlain by a soil substrate (Figure 6y; ES8, Appendix D). The OHW marks were identified by a slight break in slope, and a decrease in vegetative cover from the stream banks to the low-flow channel, which was consistent with the OHW marks. Outside of the seasonal wetland at SCC57, the streambed of Tennant Creek has a soil substrate and was sparsely vegetated with upland herbaceous plant species such as bigleaf periwinkle (*Vinca major*, UPL) (Figure 6a; ES57, Appendix D). The lack of hydrophytic vegetation in this portion of the channel allowed for the determination of this area as other waters, rather than a part of the abutting seasonal wetland. The canopy of camphora and Northern California walnut trees also hung above the channel. The OHW marks at SCC57 were identified by the presence of a slight break in slope, drainage patterns (matted vegetation), the presence of drift and debris, and a decrease in vegetative cover from the stream banks to the bed. The low-flow channels at SCC8 and SCC57 were consistent with the OHW marks.

The streambed of Elephant Head Creek at PC34 had two low-flow channels, both of which supported very little vegetation and had cobble substrates with a small proportion of soil (Figure 6z; ES34, Appendix D). The BSA, however, did not span the width of the stream, and only encompassed a portion of the westernmost low-flow channel. The low-flow channels were separated by a 3-foot mound which was covered by mulefat (FAC). This species is a phreatophyte (deeply rooted species) which is capable of sending down it taproot as much as 25 feet or more below the ground surface; as such, it is not considered a reliable indicator. The OHW mark was identified by a break in slope, the presence of drift and debris below the OHW mark, a change in sediment texture from medium silt on the stream bank to cobble below the OHW mark, and a decrease in vegetative cover from the stream bank to the bed. The banks of Elephant Head Creek were steep and eroded, and a headcut was present near the BSA boundary.

3.2.3 Areas Not Meeting the Regulatory Definition of Waters of the U.S./State

The remainder of the BSA (approximately 166,343 square feet) did not meet the regulatory definitions of jurisdictional waters (Figures 6a-c and 6e-za; Photographs 1, 3, 6-8, 10, 11, 14, 16, 17, 19-22, 25, 27-29, 35, 41, and 44; Appendix E). Nine of sixteen soils pits were located in uplands (SP57b, SP54, SP52b, SP21b, SP20, SP19b, 18, SP11a, and SP2b, Appendix C). Uplands within the BSA were comprised of annual grassland, agricultural land, ornamental woodland, California sycamore alluvial woodland, and urban-suburban habitat. Potentially non-jurisdictional waters were also included in the upland habitat type, and were observed within the limits of the BSA at SCC21, SCC24, SCC35, SCC53, and SCC54 (Photographs 13, 15, 16, and 26, Appendix E). These features were roadside and agricultural ditches with no OHW mark indicators. In addition, these drainage ditches are artificial features that do not replace any natural stream channels or drainages, and they are currently managed to keep vegetation from establishing in the channels. One soil pit was placed in a an agricultural ditch at SCC54 (SP54, Appendix C). Ditches did not support a significant hydrophytic community and only carry surface runoff during and immediately rainfall events. As such, they are not expected to be considered potentially jurisdictional other waters. Non-jurisdictional wetlands were not observed within the BSA.

During the March, April, and May 2014 site visits, annual grassland habitat and ranch lands were dominated by wild oats, ripgut brome (*Bromus diandrus*, UPL), meadow barley (*Hordeum murinum*, FACU), seaside barley, lamb's quarters (*Chenopodium album*, FACU), and spring vetch (*Vicia sativa*, FAC). Much of the agricultural land had been cleared for planting spring and summer crops at the time of the survey, but where vegetation was present, the community was dominated by wild oats, Italian ryegrass, black mustard (*Brassica nigra*, UPL), and jointed charlock (*Raphanus sativus*, UPL). Dirt roads and driveways were considered annual grassland and agricultural land, and were contiguous with the surrounding habitats. Plant species composition in these areas was similar, and in many cases identical, to that of the adjacent habitats because these roads experience little traffic, and are primarily used for maintenance activities. The overstory of ornamental woodland habitat at SCC57 was dominated by Northern California black walnut (*Juglans hindsii*), camphora, and coast live oak (*Quercus agrifolia*). Dominant shrubs included Carolina laurel cherry (*Prunus caroliniana*) and Sierra plum (*Prunus subcordata*). The overstory of the California sycamore alluvial woodland at PC2 was dominated by California sycamore, and the shrub layer was dominated by mulefat and coyote brush (*Baccharis pilularis*, UPL). Hardscape, such as paved roads and driveways, and landscaped areas were considered urban-suburban habitat. Uplands across the BSA were generally underlain by clay and clay loam soil, with the exception of the sycamore alluvial woodland at PC2, which was underlain by cobble, with a small proportion of loam within the top 6 inches of the soil profile. No hydric soil or hydrology indicators were observed in these areas.

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Appendix A. Plants Observed

Family	Scientific name	Synonyms	Common name	Indicator Status
Apiaceae	*Anthriscus caucalis*		bur chervil	UPL
	Conium maculatum		poison hemlock	FACW
	Foeniculum vulgare		fennel	UPL
Apocynanceae	*Vinca major*		bigleaf periwinkle	UPL
Asteraceae	*Artemisia douglasiana*		mugwort	FAC
	Baccharis pilularis ssp. *consanguinea*		coyote brush	UPL
	Baccharis salicifolia ssp. *salicifolia*		mule fat	FAC
	Carduus pycnocephalus ssp. *pycnocephalus*		Italian thistle	UPL
	Centaurea solstitialis		yellow star thistle	UPL
	Centaurea stoebe ssp. *micranthos*		spotted knapweed	UPL
	Cichorium intybus		chicory	UPL
	Cirsium vulgare		bull thistle	FACU
	Dittrichia graveolens		stinkwort	UPL
	Grindelia camporum		common gumplant	FACU
	Helminthotheca echioides	*Picris echioides*	bristly ox-tongue	FACU
	Lactuca serriola		wild lettuce	FACU
	Matricaria discoidea		pineapple weed	FACU
	Silybum marianum		milkthistle	UPL
	Sonchus asper ssp. asper		prickly sow thistle	FAC
	Taraxacum officinale		common dandelion	FACU
	Tragopogon porrifolius		purple salsify	UPL
	Xanthium strumarium		rough cocklebur	FAC
Boraginaceae	*Amsinckia intermedia*		common fiddleneck	UPL
	Pholistoma membranaceum		white fiesta flower	UPL
Brassicaceae	*Brassica nigra*		black mustard	UPL
	Brassica rapa		field mustard	UPL
	Cardamine californica		California toothwort	UPL
	Hirschfeldia incana		Mediterranean hoary mustard	UPL
	Lepidium draba	*Cardaria draba*	whitetop	UPL
	Raphanus sativus		jointed charlock	UPL
Caryophyllaceae	*Stellaria media*		common chickweed	FACU

Chenopodiaceae	*Chenopodium album*		lamb's quarters	FACU
	Salicornia sp.		pickleweed	OBL
Convolvulaceae	*Convolvulus arvensis*		field bindweed	UPL
	Cressa truxillensis		alkali weed	FACW
Cyperaceae	*Carex nudata*		naked sedge	FACW
	Cyperus eragrostis		tall flatsedge	FACW
Fagaceae	*Quercus agrifolia*		coast live oak	UPL
	Quercus lobata		valley oak	FACU
Fabaceae	*Lotus corniculatus*		bird's foot trefoil	FAC
	Lupinus bicolor		miniature lupine	UPL
	Lupinus succulentus		arroyo lupine	UPL
	Medicago polymorpha		bur medic	FACU
	Melilotus indicus		annual yellow sweet clover	FACU
	Vicia sativa		spring vetch	FACU
	Trifolium hirtum		rose clover	UPL
	Trifolium repens		white clover	FACU
Geraniaceae	*Erodium cicutarium*		redstem filaree	UPL
	Geranium dissectum		cutleaf geranium	UPL
	Geranium molle		woodland geranium	UPL
Juglandaceae	*Juglans hindsii*		Northern California black walnut	FAC
Juncaceae	*Eleocharis macrostachya*	*Eleocharis palustris*	common spikerush	OBL
	Juncus bufoniusvar. bufonius		toadrush	FACW
	Juncus mexicanus		Mexican rush	FACW
	Juncus xiphioides		iris-leaved rush	OBL
Lamiaceae	*Mentha spicata*		spearmint	OBL
	Lamium amplexicaule		giraffe head	UPL
	Marrubium vulgare		white horehound	FACU
Lauraceae	*Cinnamomum camphora*		camphor tree	UPL
Malvaceae	*Malva nicaeensis*		bull mallow	UPL
Montiaceae	*Claytonia perfoliata*		miner's lettuce	FAC
Myrsinaceae	*Anagallis arvensis*		scarlet pimpernel	UPL
Oleaceae	*Olea europaea*		olive	UPL
Onagraceae	*Epilobium brachycarpum*		tall willowherb	UPL
Papaveraceae	*Eschscholzia californica*		California poppy	UPL
Plantaginaceae	*Plantago lanceolata*		ribgrass	FAC
	Plantago coronopus		buckhorn plantain	FACW
	Veronica persica		birdeye speedwell	UPL
Platanaceae	*Platanus racemosa*		California sycamore	FAC
Poaceae	*Agrostis stolonifera*		creeping bentgrass	FACW

	Avena barbata		slender wildoats	UPL
	Avena fatua		common wildoats	UPL
	Briza minor		little quaking grass	FAC
	Bromus catharticus		rescue grass	UPL
	Bromus diandrus		ripgut brome	UPL
	Bromus hordeaceus		soft chess	FACU
	Bromus madritensis		spanish brome	UPL
	Cynodon dactylon		bermuda grass	FACU
	Distichilis spicata		saltgrass	FAC
	Elymus triticoides	*Leymus triticoides*	beardless wildrye	FAC
	Festuca perennis	*Lolium perenne*	Italian ryegrass	UPL
	Hordeum marinum		seaside barley	FAC
	Hordeum murinum		meadow barley	FACU
	Phalaris aquatica		harding grass	FACU
	Poa sp.			-
	Polypogon monspeliensis		annual rabbitsfoot grass	FACW
	Triticum aestivum		common wheat	UPL
Polygonaceae	*Persicaria* sp.	*Polygonum* sp.	smartweed	FACW/OBL
	Polygonum aviculare ssp. *depressum*		prostrate knotweed	FACW
	Rumex conglomeratus		clustered dock	FACW
	Rumex crispus		curly dock	FAC
Ranunculaceae	*Ranunculus californicus* var. *californicus*		California buttercup	FACU
Rosaceae	*Prunus caroliniana*		Carolina laurelcherry	FACU
	Prunus subcordata		Sierra plum	UPL
Rubiaceae	*Galium aparine*		stickywilly	FACU
	Galium sp.		bedstraw	-
Typhaceae	*Typha* sp.		cattail	OBL
Verbenaceae	*Phyla nodiflora*		turkey tangle fogfruit	FACW

The species are arranged alphabetically by family name for all vascular plants encountered during the plant survey. Plants are also listed alphabetically within each family. Species nomenclature is from Baldwin (2012). Former names have also been included for species where the nomenclature has not been updated on the National Wetland Inventory.

Wetland Indicator Status Key:

OBL = Obligate wetland species, occur almost always in wetlands.

FACW = Facultative Wetland species, usually occur in wetlands, but may also occur in non-wetlands.

FAC = Facultative species, occur in wetlands and non-wetlands.

FACU = Facultative Upland species, usually occur in non-wetlands, but may occur in wetlands.

UPL = Upland species, almost never occur in wetlands.

NI = Non-iIndicator, not present on list.

Appendix B. Soils of Eastern Santa Clara County, CA and San Benito County, CA

SOIL SURVEY OF

Eastern Santa Clara Area, California

United States Department of Agriculture
Soil Conservation Service
In cooperation with
University of California
Agricultural Experiment Station

Issued September 1974

Major fieldwork for this soil survey was done in the period 1960–65. Soil names and descriptions were approved in 1967. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1967. This survey was made cooperatively by the Soil Conservation Service and the University of California Agricultural Experiment Station. It is part of the technical assistance furnished to the Evergreen, Loma Prieta, and part of the Bolado-Fairview Resource Conservation Districts.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for agriculture, industry, and recreation.

Locating Soils

All the soils of the Eastern Santa Clara Area are shown on the detailed map at the back of this survey. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbol. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information in the survey. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described, gives the page for the capability unit, wildlife group, and range site in which the soil has been placed, and lists the Storie index rating that applies to each soil.

Individual colored maps showing the relative suitability or limitations of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and range sites.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife and Fish."

Ranchers and others can find, under "Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of Soils."

Newcomers in the Eastern Santa Clara Area may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the Area."

Cover: Prunes growing on soils in the Azule-Altamont association. Photo courtesy Sunsweet Growers.

U.S. GOVERNMENT PRINTING OFFICE: 1974

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

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Issued September 1974

SOIL SURVEY OF THE EASTERN SANTA CLARA AREA, CALIFORNIA

BY WESLEY C. LINDSEY, SOIL CONSERVATION SERVICE

FIELDWORK BY WESLEY C. LINDSEY AND CHARLES J. WEISEL,
SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION

THE EASTERN SANTA CLARA AREA is in Santa Clara County, which is located in the west-central part of California (fig. 1). The survey area has a total land area of 815 square miles, or 519,280 acres. The topography of Santa Clara County consists of three principal physiographic features: the Santa Clara Valley, the Santa Cruz Mountains, and the Diablo Range.

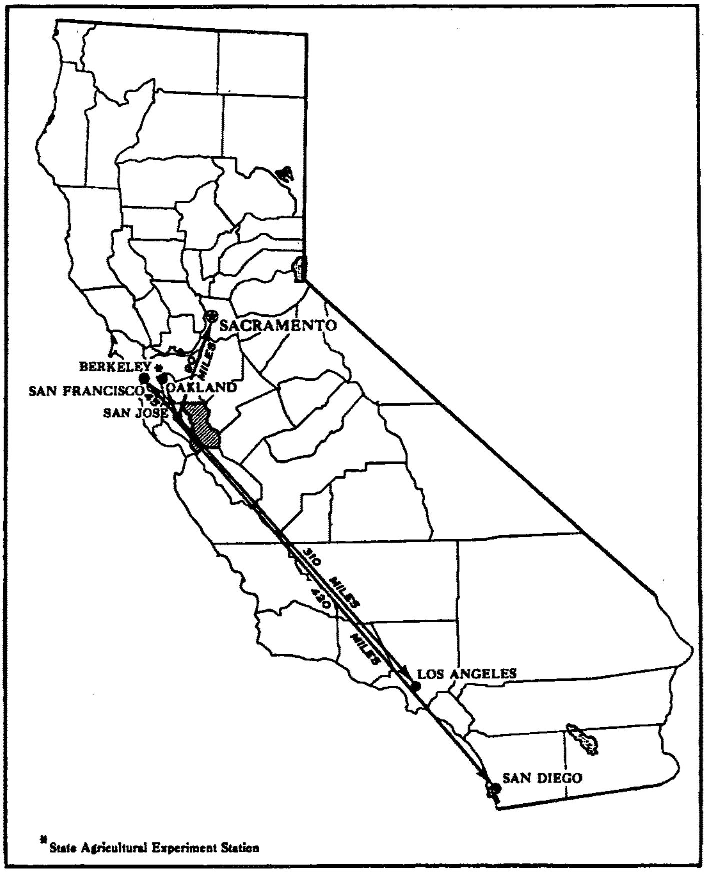

Figure 1.—Location of Eastern Santa Clara Area in California.

The survey area includes the southern part of Santa Clara Valley, from the town of Coyote south to the San Benito County line. This area is made up of deep, rich, alluvial soils. Along the edges of the valley on terraces are soils that have a clayey subsoil. Poorly drained soils are in a few areas throughout the valley. Because of its latitude, surrounding mountains, and proximity to the Pacific Ocean, the valley has a mild, equable climate most of the year.

The eastern part of the survey area includes that part of Santa Clara County that lies in the Diablo Range. These mountains comprise a number of parallel, well-rounded ridges. The vegetation is mainly grass and trees, but some areas are covered by brush. Pacheco and Coyote Creeks are practically the only streams draining into the southern part of Santa Clara Valley. This part of the survey area is used mostly for grazing. Average annual rainfall ranges from 15 to 30 inches.

The Santa Cruz Mountains separate the Santa Clara Valley from the sea. These mountains, from a point 4 miles north of Mt. Madonna, are included in this survey. Soils of this area have steep to very steep slopes. The natural vegetation is dense brush or trees. The lower foothills are used for range. Brush and timber areas are used mainly for recreation, wildlife, summer homesites, and watershed. Average annual rainfall is 20 to 50 inches. Drainage from this area is largely through tributaries of the Pajaro River and Llagas, Uvas, Little Arthur, and Bodfish Creeks.

As far as is known, the Indians that occupied Santa Clara Valley before the white man came practiced little or no farming. The mild climate and abundant game, fish, herbs, and berries made farming unnecessary. The earliest farming in the area was intended to make the newly established missions and the Spanish soldiers in the region independent of supplies from Mexico.

In recent years farm acreage in Santa Clara County has been reduced by residential and industrial development; however, agriculture is still of considerable importance. The principal crops are fruits, nuts, cut flowers, sugar beets, and fresh vegetables. The growing season is long enough for most crops, especially vegetables and cut flowers. In summer rainfall is limited and irrigation is needed for crops. Livestock is produced in the foothills and mountainous areas where forage is abundant.

The economy of Santa Clara County is mainly dependent on electronics and missile research, development, and production. The production of food processing equipment, nonelectrical machinery, and transportation equipment is also important.

San Jose, the county seat and largest city in Santa Clara County, is not in the survey area. Morgan Hill and Gilroy are the largest incorporated towns in the survey area. Gilroy, the larger of the two, ranks ninth among the cities of Santa Clara County and has an estimated population of 6,350.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in the Eastern Santa Clara Area, where they are located, and how they can be used. They went into the area knowing they likely would find many soils they had already seen and perhaps some they had not. They noted the steepness, length, and shape of slopes, the kinds of native plants or crops, the kinds of rock, and many other facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* (*10*) [1] are the categories of soil classification most used in local surveys.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Altamont and Campbell, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in surface soil texture and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Altamont clay, 15 to 30 percent slopes, is one of several phases within the Altamont series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units shown on the soil map of the Eastern Santa Clara Area are soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. The Gaviota-Los Gatos complex is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Zamora and Cropley soils is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Rock land is a land type in the Eastern Santa Clara Area.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is complete when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. Then the scientists adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the Eastern Santa Clara Area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

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[1] Italic numbers in parentheses refer to Literature Cited, p. 88.

A map showing soil associations is useful to people who want a general idea of the soils in an area, who want to compare different parts of an area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The eleven soil associations in the Eastern Santa Clara Area have been divided into three groups according to some dominant feature of texture, drainage, slope or landform, and position. The terms for texture used in the title for several of the associations apply to the surface layer. For example, in association 1 the words "loams and silty clay loams" refer to texture of the surface layer.

Areas Dominated by Very Deep, Well-Drained to Poorly Drained Soils on Alluvial Plains, Fans, and Stream Benches

This group consists of level to strongly sloping soils that developed in alluvium derived mainly from sedimentary rock. The vegetation consists of grasses, forbs, and scattered oak trees. Elevation ranges from 100 to 2,400 feet. Average annual rainfall is 15 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days. Most areas of these soils are in the Santa Clara Valley; smaller areas are in small valleys in the Diablo Range. Differences in characteristics of the soils in this group are caused by minor differences in parent material, stage of soil development, and drainage. These soils occupy about 13 percent of the survey area.

These intensively cultivated soils are used for row crops, sugar beets, orchards, vineyards, hay and pasture, and range. Housing and commercial developments are rapidly expanding on these soils.

1. Yolo association

Nearly level to sloping, well-drained loams and silty clay loams; on alluvial plains and fans

This association is on alluvial plains and fans of the Santa Clara Valley along the major drainageways. It consists of soils that developed in alluvium from sedimentary rock. These soils have slopes of 0 to 9 percent. Where these soils are not cultivated, the vegetation consists of annual grasses, forbs, and a few scattered oak trees. Elevation ranges from 400 to 1,000 feet. Average annual rainfall is 15 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days.

This association occupies about 5 percent of the survey area. Yolo soils make up about 85 percent of this association. The remaining 15 percent consists of Campbell, Garretson, Cortina, and Esparto soils, and of Riverwash.

Yolo soils have a grayish-brown loam and silty clay loam surface layer and a brown silt loam substratum. The hazard of flooding generally does not exist on these soils, except for a few areas in lower positions along drainageways.

These soils are used for irrigated row crops, orchards, vineyards, dryland hay, and pasture. The principal crops are apricots, cherries, prunes, and walnuts. These are the most productive soils in the Eastern Santa Clara Area. The largest expansion of housing and related commercial developments has taken place on these soils.

2. Arbuckle-Pleasanton association

Nearly level to strongly sloping, well-drained gravelly loams and loams; on older alluvial fans

This association is along the edges of the Santa Clara Valley, around Morgan Hill and San Martin. It consists of soils that developed in alluvium from sedimentary rock. These soils have slopes of 0 to 15 percent. Where these soils are not cultivated, the vegetation consists of annual grasses, forbs, and scattered oaks. Elevation ranges from 200 to 1,000 feet. Average annual rainfall is 15 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days.

This association occupies about 5 percent of the survey area. Arbuckle soils make up about 60 percent of this association, and Pleasanton soils 25 percent. The remaining 15 percent consists of San Ysidro and Hillgate soils.

The dominant soils in this association are well drained. The Arbuckle soils have a brown and pale-brown gravelly loam surface layer and a brown and yellowish-brown gravelly loam subsoil. The substratum is brown very gravelly sandy loam. Pleasanton soils have a grayish-brown loam and gravelly loam surface layer and a dark grayish-brown, brown, and yellowish-brown clay loam, gravelly clay loam, and gravelly sandy clay loam subsoil. The substratum of these soils is gravelly alluvium of variable texture.

These soils are used for irrigated row crops, orchards, dryland hay, pasture, and range. Some areas are also used for housing and commercial developments.

3. Cropley-Rincon association

Nearly level to sloping, well-drained clays and clay loams; on alluvial fans

This association is along the edges of Santa Clara Valley. It consists of soils that developed in calcareous alluvium from mixed sources. These soils have slopes of 0 to 9 percent. Where these soils are not cultivated, the vegetation consists of grasses, forbs, and a few scattered oak trees. Elevation ranges from 130 to 1,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is about 58° to 60° F. The growing season is 250 to 275 days.

This association occupies about 1 percent of the survey area. Cropley soils make up 60 percent of this association, and Rincon soils 25 percent. The remaining 15 percent consists of San Ysidro, Pleasanton, and Zamora soils.

The dominant soils of this association are well drained. The Cropley soils have a very dark gray clay surface layer and a dark grayish-brown clay substratum. Rincon soils have a dark gray clay loam surface layer and a grayish-brown gravelly clay and clay subsoil. The substratum of these soils is mixed alluvium that ranges from gravelly clay loam to clay and is commonly calcareous.

These soils are used for irrigated row crops, sugar beets, apricots, prunes, walnuts, grapes, dryland hay, and pasture. They are more difficult to manage than the soils in the valley, and productivity is lower. Well water is available for irrigation.

4. *Clear Lake-Pacheco-Sunnyvale association*

Nearly level, poorly drained clays to clay loams; in low positions on alluvial plains and fans

This association is on the valley floor near Soap Lake and Tulare Hill. It consists of soils that developed in mottled alluvium from sedimentary rock. These soils have slopes of less than 2 percent. Elevation ranges from 100 to 300 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days.

This association occupies about 2 percent of the survey area. Clear Lake soils make up about 35 percent of this association, Pacheco soils 35 percent, and Sunnyvale soils 15 percent. The remaining 15 percent consists of areas of Campbell and Willows soils.

The dominant soils of this association are poorly drained. Clear Lake soils have a dark-gray clay surface layer and a grayish-brown, calcareous clay substratum. Pacheco soils have a grayish-brown fine sandy loam, silt loam, and clay loam surface layer and a mottled, light-gray, calcareous loam and very fine sandy loam substratum. Sunnyvale soils have a dark-gray, calcareous silty clay surface layer and a light-gray and gray, calcareous silty clay substratum. Free water generally occurs at a depth of 2½ to 5 feet, except where the soils are drained.

These soils are used for irrigated row crops, sugar beets, orchards, hay, and pasture.

Areas Dominated by Shallow to Moderately Deep, Well Drained to Moderately Well Drained Soils on Old Fans and Terraces

This group consists of nearly level to steep soils that have a clay subsoil and that developed in alluvium derived from sedimentary rock. These soils are on old fans and terraces that lie between the more recent alluvial soils of the valley floor and the soils of the uplands. The vegetation consists of grasses, forbs, and scattered oaks. Elevation ranges from 200 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days. These soils occupy about 3 percent of the survey area.

Nearly all of the soils are cultivated and are used for orchards, vineyards, hay, pasture, and range. Because of slope, clay subsoil, and cultivation practices, most areas of these soils are eroded. Limited water for irrigation is available.

5. *Hillgate-San Ysidro association*

Nearly level to steep, well drained to moderately well drained silt loams and loams having a clay and clay loam subsoil

This association is along the edges of Santa Clara Valley. It consists of soils that developed in alluvium from sedimentary rock. These soils have slopes of 0 to 50 percent. Where these soils are not cultivated, the vegetation consists of annual grasses and scattered oaks. Elevation ranges from 200 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days.

This association occupies about 3 percent of the survey area. Hillgate soils make up about 50 percent of this association, and San Ysidro soils 35 percent. The remaining 15 percent consists of Keefers, Pleasanton, Arbuckle, Los Robles, and Zamora soils.

Hillgate soils are well drained and have slopes of 2 to 50 percent on the higher terraces. They have a pale-brown and brown silt loam surface layer and a strong-brown and brownish-yellow clay and clay loam subsoil. The underlying material is brownish-yellow gravelly clay loam alluvium. The San Ysidro soils are moderately well drained and have slopes of 0 to 5 percent on old fans. They have a light brownish-gray loam surface layer and a mottled, brown and yellowish-brown clay subsoil. The substratum is mottled light yellowish-brown clay loam and sandy clay loam.

These soils are used for irrigated apricots, prunes, and vineyards. Without irrigation, they are used primarily for grain hay, dryland pasture, and range. The limited irrigation water available is obtained mainly from wells.

Areas Dominated by Shallow to Deep, Well-Drained to Somewhat Excessively Drained Soils on Uplands

This group consists of gently sloping to very steep soils on mountainous uplands. Because of the wide variety of parent rock and the marked differences in climate, a relatively large number of soils is represented in this group. The vegetation is grasses, brush, woodland, or conifer forests. Elevation ranges from 200 to 4,000 feet. Average annual rainfall is 15 to 50 inches, and average annual temperature is 55° to 60° F. The growing season is 200 to 275 days. These soils occupy about 81 percent of the survey area.

Most of the soils in this group are used for vineyards, Christmas tree production, pasture, grain, hay, range, watershed, wildlife, and recreation. A few areas are used for the production of timber.

6. *Azule-Altamont association*

Strongly sloping to very steep, well-drained, moderately deep and deep clays and clay loams

This association is on the foothills around the edges of Santa Clara Valley. It consists of soils that developed on soft sediments. These soils have slopes of 9 to 75 percent. Vegetation is mostly annual and perennial grasses, forbs, and scattered oaks. Elevation ranges from 500 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is 200 to 250 days.

This association comprises about 2 percent of the survey area. Azule soils make up about 55 percent of this association, and Altamont soils about 30 percent. The remaining 15 percent consists of Diablo, Los Osos, and San Benito soils.

The dominant soils of this association are moderately deep to deep and are well drained. Azule soils have a dark grayish-brown clay loam surface layer and a brown and yellowish-brown gravelly sandy clay subsoil. The substratum is light yellowish brown gravelly sandy clay loam sediments. Altamont soils have a dark grayish-brown and grayish-brown clay surface layer and a light-gray, calcareous clay substratum. They overlie fractured, calcareous shales.

These soils are used for dryland orchards, vineyards, grain hay, pasture, range, wildlife, and watershed. The soils of this association are the high forage-producing rangeland soils in the survey area.

7. *Los Osos-San Benito association*

Moderately steep to very steep, well-drained, moderately deep and deep clay loams

This association is east of Soap Lake and around Sargent oil fields. It consists of soils that developed on sandstone and shale. These soils have slopes of 15 to 75 percent. Vegetation is mostly annual and perennial grasses, forbs, and scattered oaks. Elevation ranges from 300 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is 200 to 250 days.

This association occupies about 1 percent of the survey area. Los Osos soils make up 55 percent of this association, and San Benito soils about 30 percent. The remaining 15 percent consists of Diablo, Gaviota, and Vallecitos soils.

The dominant soils in this association are moderately deep to deep and are well drained. Los Osos soils have a dark grayish-brown clay loam surface layer and a dark-brown clay subsoil. The underlying material is sandstone bedrock. San Benito soils have a dark grayish-brown clay loam surface layer and a yellowish-brown, calcareous clay loam substratum. The underlying material is calcareous shale.

These soils are used for dryland hay, pasture, and range.

8. *Los Gatos-Gaviota-Vallecitos association*

Gently sloping to very steep, well-drained and somewhat excessively drained, shallow to deep gravelly loams and loams

This association is in the uplands on both sides of the Santa Clara Valley. It consists of soils that developed on hard sandstone and shale. These soils have slopes of 5 to 75 percent. Where these soils are not cultivated, the vegetation is annual grasses and forbs and some oak, Digger pine, and brush. Elevation ranges from 300 to 4,000 feet. Average annual rainfall is 15 to 40 inches, and average annual temperature is 55° to 60° F. The growing season is 200 to 250 days.

This association occupies about 37 percent of the survey area. Los Gatos soils make up 30 percent of the association, Gaviota soils 30 percent, and Vallecitos soils about 25 percent. The remaining 15 percent consists of Gilroy, Inks, Los Osos, Parrish, San Andreas, and Santa Lucia soils.

Los Gatos soils are moderately deep and deep and are well drained. They have a brown gravelly loam surface layer and a brown, reddish-brown, and yellowish-brown gravelly clay loam subsoil that is underlain by metamorphosed shale. Gaviota soils are shallow and are well drained and somewhat excessively drained. They have a pale-brown loam and light yellowish-brown gravelly loam surface layer underlain by hard sandstone. Vallecitos soils are shallow and moderately deep and are well drained. They have a brown loam surface layer and a dark-brown clay loam and reddish-brown clay subsoil underlain by metamorphosed hard shales. Some areas have rock outcrops, and some are moderately eroded to severely eroded.

These soils are used for vineyards, hay, pasture, range, wildlife, recreation, and watershed. This association comprises the largest area of range soils in the survey area.

9. *Gaviota association*

Steep to very steep, shallow, somewhat excessively drained, eroded gravelly loams

This association is in the Diablo Range just east of Mt. Hamilton and extends from the Alameda-Santa Clara County line south to Mustang Peak. It consists of soils that developed on hard sandstone and shales. These soils have slopes of 30 to 75 percent. Vegetation is low chamise with a scanty grass and forb understory. Elevation ranges from 500 to 4,000 feet. Average annual rainfall is 15 to 30 inches, and average annual temperature is 58° to 60° F. The growing season is 200 to 250 days.

This association comprises about 31 percent of the survey area. Gaviota gravelly loam soils make up about 85 percent of this association. The remaining 15 percent consists of Vallecitos, Los Gatos, and Henneke soils.

Gaviota soils are shallow and are somewhat excessively drained. They have a pale-brown gravelly loam surface layer that is underlain by hard sandstone. Some areas have rock outcrops, and most areas are moderately to severely eroded.

These soils are used for range, wildlife, watershed, and recreation (fig. 2).

10. *Felton-Maymen association*

Moderately steep to very steep, well-drained and somewhat excessively drained, deep to shallow silt loams and fine sandy loams

This association is on uplands that extend along the Santa Cruz-Santa Clara County line. It consists of soils that developed on sandstone and shale. Vegetation is mainly redwood, Douglas-fir, coniferous forest, and associated hardwoods; brush is the dominant cover on the Maymen soils. These soils have slopes of 15 to 75 percent. Elevation ranges from 500 to 4,000 feet. Average annual rainfall is 30 to 50 inches, and average temperature is 55° to 56° F. The growing season is 200 to 250 days.

This association occupies about 10 percent of the survey area. Felton soils make up 65 percent of this association, and Maymen soils about 20 percent. The remaining 15 percent consists of Ben Lomond and Madonna soils.

Felton soils are well drained and moderately deep and deep. They have a brown silt loam surface layer and a brown, light-brown, and light yellowish-brown clay loam subsoil that is underlain by interbedded shale and sandstone. Felton soils that have been logged show some sheet, gully, and rill erosion. Maymen soils are somewhat excessively drained and shallow. They have a brown fine sandy loam surface layer and a light-brown fine sandy loam subsoil that is underlain by hard sandstone. Maymen soils are commonly eroded, and 2 to 10 percent of their surface area is rock outcrops.

These soils are used mainly for grain hay, range, Christmas trees, wildlife, recreation, and watershed. Some timber is harvested on the Felton soils.

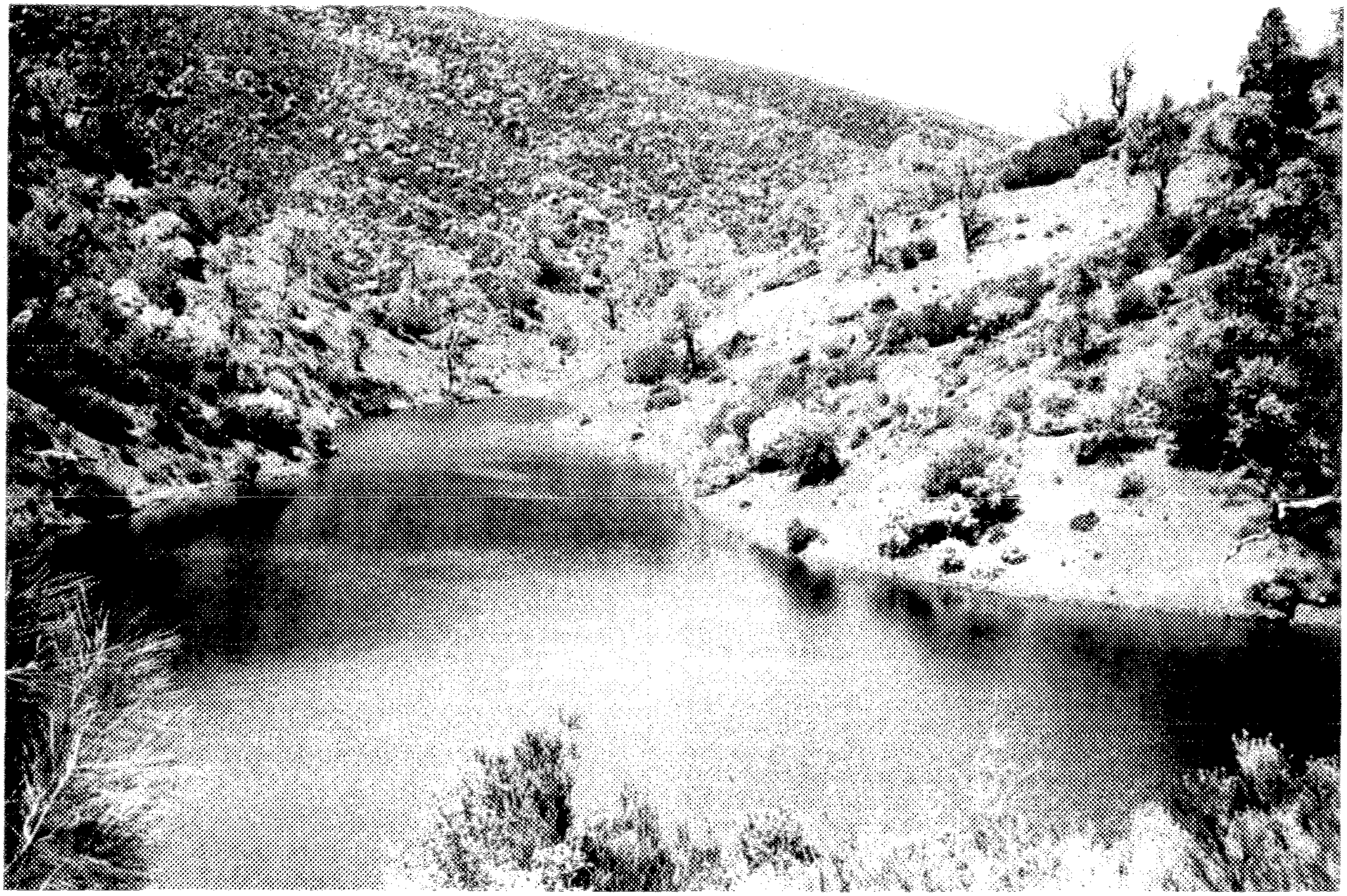

Figure 2.—**Area of eroded Gaviota soils that has limited use for range, wildlife, watershed, and recreation.**

11. Montara-Inks-Henneke association

Moderately steep to very steep, somewhat excessively drained, shallow clay loams and gravelly clay loams

This association is mainly on uplands along the foothills that extend from Tulare Hill to Anderson Lake and around Red Mountain; smaller areas are throughout the survey area. It consists of soils that developed on serpentine and metamorphosed basalt bedrock. These soils have slopes of 15 to 75 percent. Natural vegetation is grasses, forbs, and brush. Elevation ranges from 200 to 3,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is 200 to 275 days.

This association occupies about 3 percent of the survey area. Montara soils make up about 45 percent of this association, Inks soils 20 percent, and Henneke soils 20 percent. The remaining 15 percent consists of Climara, Gilroy, Gaviota, Los Gatos, and Vallecitos soils.

The dominant soils of this association are shallow and somewhat excessively drained. Montara soils have a dark gray and very dark gray clay loam surface layer that is underlain by serpentine bedrock. About 5 to 10 percent of the surface is covered by rock outcrops. Inks soils have a brown gravelly clay loam surface layer and a dark reddish-brown gravelly clay loam subsoil that is underlain by hard, shattered, metamorphosed basalt. About 2 to 10 percent of the surface is covered by rock outcrops, and there is a variable amount of stones on the surface. Henneke soils have a reddish-brown gravelly clay loam surface layer and a dark reddish-brown very gravelly clay subsoil that is underlain by serpentine bedrock. About 2 to 10 percent of the surface is covered by rock outcrops. These soils are moderately eroded to severely eroded.

These soils are used for range, wildlife, watershed, and recreation.

Descriptions of the Soils

This section provides detailed information about the soils in the survey area. It describes each soil series, and then each soil, or mapping unit. The soils are described in alphabetical order.

The description of a soil series mentions features that apply to all the soils of that series. Differences among the soils of one series are pointed out in the descriptions of the individual soils or are apparent in the name.

A profile representative of each series is described in detail in the first mapping unit. This profile is for scientists, engineers, and others who need to make highly technical soil interpretations. The layers, or horizons, are designated by symbols such as A1, B21t, and C1. These symbols have special meaning for soil scientists. Many readers, however, need only remember that symbols beginning with "A" are for surface layer; those with "B" are for subsoil; those with "C" are for substratum, or parent material; and those with "R" are for bedrock. All measurements refer to depth from the surface.

The color of each horizon is described in words, such as yellowish brown, and is also indicated by symbols for hue, value, and chroma, such as 10YR 5/4. These symbols, which are called Munsell color notations, are used by soil scientists to evaluate the color of the soil precisely. Unless otherwise stated, all color terms in the survey are for dry soil.

The texture of the soil refers to the content of sand, silt, and clay. It is determined by the way the soil feels when rubbed between the fingers, and it is checked by laboratory analyses. Each mapping unit is identified by a textural class name, such as fine sandy loam. This name refers to the texture of the surface layer or A horizon.

The structure is indicated by the way the individual soil particles are arranged in larger grains, or aggregates, and by the amount of pore space between grains. The structure of the soil is described by terms that denote strength or grade, size, and shape of the aggregates. For example, a horizon may consist of soil materials that have weak, fine, blocky structure.

Boundaries between the horizons are described so as to indicate their thickness and shape. The terms for thickness are *abrupt*, *clear*, *gradual*, and *diffuse*. The shape of the boundary is described as *smooth*, *wavy*, *irregular*, or *broken*.

Other terms used for describing the soils are defined in the Glossary. For more general information about the soils, the reader can refer to the section "General Soil Map," in which the broad patterns of soils are described. The approximate acreage and proportionate extent of the soils are given in table 1, and their location and extent are shown on the detailed soil map at the back of this survey.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Altamont clay, 30 to 50 percent slopes	1, 120	0. 2
Altamont clay, 15 to 30 percent slopes	580	. 1
Altamont clay, 50 to 75 percent slopes, eroded	190	(1)
Arbuckle gravelly loam, 0 to 2 percent slopes	4, 140	. 8
Arbuckle loam, deep, 5 to 9 percent slopes	610	. 1
Azule clay loam, 30 to 75 percent slopes	2, 240	. 4
Azule clay loam, 9 to 15 percent slopes, eroded	190	. 1
Azule clay loam, 15 to 30 percent slopes	1, 420	. 3
Azule clay loam, 15 to 30 percent slopes, eroded	640	. 1
Azule clay loam, 30 to 75 percent slopes, eroded	1, 970	. 4
Ben Lomond fine sandy loam, 50 to 75 percent slopes	520	. 1
Campbell silty clay loam	1, 560	. 3
Campbell silty clay loam, clay substratum	520	. 1
Campbell silty clay	2, 190	. 4
Campbell silty clay, muck substratum	440	. 1
Clear Lake clay, drained	1, 800	. 4
Clear Lake clay	1, 360	. 3
Clear Lake clay, saline	560	. 1
Climara stony clay, 15 to 50 percent slopes	2, 030	. 4
Climara clay, 9 to 30 percent slopes	1, 160	. 2
Cortina very gravelly loam, 0 to 5 percent slopes	1, 770	. 3
Cropley clay, 0 to 2 percent slopes	2, 540	. 5
Cropley clay, 2 to 9 percent slopes	920	. 2
Diablo clay, 9 to 15 percent slopes	210	(1)
Diablo clay, 30 to 50 percent slopes	150	(1)
Esparto loam, 0 to 2 percent slopes	250	. 1
Esparto loam, 2 to 9 percent slopes	580	. 1
Felton silt loam, 50 to 75 percent slopes	3, 080	. 6
Felton silt loam, 15 to 30 percent slopes	230	(1)
Felton silt loam, 30 to 50 percent slopes	330	. 1
Garretson loam, gravel substratum, 0 to 2 percent slopes	1, 770	. 3
Garretson gravelly loam, 0 to 5 percent slopes	1, 620	. 3
Gaviota loam, 30 to 75 percent slopes	43, 560	8. 4
Gaviota loam, 5 to 15 percent slopes, eroded	3, 550	. 7
Gaviota loam, 15 to 30 percent slopes	8, 310	1. 6
Gaviota gravelly loam, 30 to 75 percent slopes, eroded	68, 200	13. 7
Gaviota gravelly loam, 30 to 75 percent slopes, severely eroded	33, 560	6. 4
Gaviota rocky loam, 5 to 30 percent slopes, eroded	6, 250	1. 2
Gaviota-Los Gatos complex, 30 to 50 percent slopes	31, 800	6. 1
Gilroy clay loam, 30 to 50 percent slopes	7, 310	1. 2
Gilroy clay loam, 5 to 30 percent slopes	1, 690	. 3
Gilroy clay loam, 15 to 30 percent slopes, eroded	1, 200	. 2
Gilroy clay loam, 50 to 75 percent slopes	5, 590	1. 0
Henneke rocky clay loam, 30 to 75 percent slopes, severely eroded	2, 560	. 5
Hillgate silt loam, 9 to 15 percent slopes, eroded	1, 980	. 4
Hillgate silt loam, 2 to 9 percent slopes	3, 610	. 5
Hillgate silt loam, 15 to 30 percent slopes, eroded	1, 180	. 2
Hillgate silt loam, 30 to 50 percent slopes, eroded	1, 310	. 2
Inks rocky clay loam, 50 to 75 percent slopes, eroded	2, 060	. 4
Inks stony clay loam, 30 to 75 percent slopes, severely eroded	4, 960	. 9
Keefers clay loam, 2 to 9 percent slopes, eroded	2, 420	. 5
Keefers clay loam, 0 to 2 percent slopes	500	. 1
Landslides	1, 300	. 3
Los Gatos gravelly loam, 50 to 75 percent slopes	10, 430	2. 1
Los Gatos gravelly loam, 15 to 30 percent slopes, eroded	390	. 1
Los Gatos gravelly loam, 30 to 50 percent slopes	2, 130	(1)
Los Gatos-Gaviota complex, 50 to 75 percent slopes	57, 910	11. 0
Los Osos clay loam, 15 to 30 percent slopes	2, 610	. 5
Los Osos clay loam, 30 to 50 percent slopes	5, 170	1. 0
Los Osos clay loam, 50 to 75 percent slopes	3, 800	. 7
Los Robles clay loam, 0 to 2 percent slopes	1, 160	. 2
Los Robles clay loam, 2 to 9 percent slopes	850	. 3
Madonna loam, 30 to 50 percent slopes	1, 450	. 3
Madonna loam, 15 to 30 percent slopes	440	. 1
Madonna loam, 50 to 75 percent slopes	1, 490	. 3
Maxwell clay, 0 to 5 percent slopes	900	. 2
Maymen rocky fine sandy loam, 50 to 75 percent slopes, eroded	7, 040	1. 4
Maymen fine sandy loam, 15 to 50 percent slopes, eroded	550	. 1
Mantara rocky clay loam, 15 to 50 percent slopes, eroded	6, 360	1. 2
Pacheco clay loam	1, 490	. 3
Pacheco fine sandy loam	660	. 2
Pacheco silt loam, drained	870	. 2

TABLE 1.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Acres	Percent
Pacheco clay loam, gravelly substratum	330	0. 1
Parrish gravelly clay loam, 9 to 30 percent slopes	760	. 2
Parrish gravelly clay loam, 30 to 50 percent slopes	3, 350	. 6
Parrish gravelly clay loam, 50 to 75 percent slopes	7, 340	1. 4
Pleasanton loam, 0 to 2 percent slopes	5, 650	1. 1
Pleasanton loam, 2 to 9 percent slopes	1, 800	. 4
Pleasanton gravelly loam, 0 to 2 percent slopes	2, 680	. 5
Pleasanton gravelly loam, 2 to 9 percent slopes	2, 680	. 5
Pleasanton gravelly loam, 9 to 15 percent slopes, eroded	1, 000	. 2
Rincon clay loam, 0 to 2 percent slopes	610	. 1
Rincon clay loam, 2 to 9 percent slopes, eroded	870	. 2
Riverwash	4, 550	. 8
Rock land	2, 710	. 5
San Andreas fine sandy loam, 30 to 75 percent slopes, eroded	1, 250	. 2
San Andreas fine sandy loam, 15 to 30 percent slopes, eroded	440	(¹)
San Benito clay loam, 50 to 75 percent slopes	430	(¹)
San Benito clay loam, 15 to 30 percent slopes, eroded	160	(¹)
San Benito clay loam, 30 to 50 percent slopes	710	. 1
San Benito clay loam, 30 to 50 percent slopes, severely eroded	500	. 1
Santa Lucia shaly loam, 50 to 75 percent slopes	1, 470	0. 3
Santa Lucia shaly loam, 30 to 50 percent slopes, eroded	560	. 1
San Ysidro loam, 0 to 2 percent slopes	3, 810	. 7
San Ysidro loam, 2 to 5 percent slopes, eroded	400	. 1
San Ysidro loam, acid variant, 0 to 2 percent slopes	900	. 2
San Ysidro loam, acid variant, 2 to 9 percent slopes	800	. 2
Sunnyvale silty clay, drained	820	. 2
Sunnyvale silty clay	230	(¹)
Terrace escarpments	460	. 1
Vallecitos rocky loam, 15 to 30 percent slopes, eroded	46, 290	8. 9
Vallecitos rocky loam, 50 to 75 percent slopes, eroded	36, 240	7. 0
Willows clay	350	. 1
Yolo loam, 0 to 2 percent slopes	3, 710	. 7
Yolo loam, 2 to 5 percent slopes	430	. 1
Yolo silty clay loam, 0 to 2 percent slopes	1, 940	. 4
Yolo silty clay loam, 2 to 9 percent slopes	320	. 1
Zamora clay loam, 0 to 2 percent slopes	2, 740	. 5
Zamora loam, 0 to 2 percent slopes	540	. 1
Zamora loam, 2 to 9 percent slopes	860	. 1
Zamora clay loam, 2 to 9 percent slopes	770	. 1
Zamora and Cropley soils, 2 to 9 percent slopes, severely eroded	530	. 1
Total	519, 280	100. 0

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[1] Less than 0.05 percent.

Altamont Series

The Altamont series consists of well-drained clays that are underlain by sedimentary rock. These soils have slopes of 15 to 75 percent and are on uplands. The vegetation is mainly annual grasses, and there are a few scattered oak trees. Elevation ranges from 500 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is about 200 to 250 days. Altamont soils are associated with Azule and Climara soils.

In a representative profile, the surface layer is dark grayish-brown and grayish-brown, neutral and moderately alkaline clay about 34 inches thick. The substratum is light-gray, calcareous, moderately alkaline clay about 10 inches thick. At a depth of 44 inches is light-gray, calcareous, fractured shale. Depth to shale ranges from 25 to 56 inches.

Altamont soils are used for dryland grain, hay, pasture, and range.

Altamont clay, 30 to 50 percent slopes (AcF).—This soil is on rounded hills. The average slope is about 40 percent.

Representative profile (on south-facing hillside about 2.5 miles from country club golf course gate, on road leading to Shingle Valley; in southwest corner of SE¼SW¼ sec. 29, T. 8 S., R., 3 E.) :

A11—0 to 8 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; strong, coarse, prismatic structure parting to moderate, medium and coarse, angular blocky structure; very hard, very firm, sticky and plastic; common very fine roots; common very fine interstitial and tubular pores; many pressure faces and a few slickensides; neutral (pH 7.0) ; clear, wavy boundary. (4 to 10 inches thick.)

A12—8 to 20 inches, dark grayish-brown (2.5Y 4/2) clay; very dark grayish brown (2.5Y 3/2) moist; strong, coarse, prismatic structure; very hard, very firm, sticky and plastic; few very fine roots; common very fine interstitial and tubular pores; continuous slickensides along ped surfaces; few, soft, medium-sized lime masses; moderately alkaline (pH 8.0) ; clear, wavy boundary. (8 to 14 inches thick.)

A13ca—20 to 34 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate, coarse, prismatic structure; very hard, very firm, sticky and plastic; few very fine roots; many very fine interstitial and tubular pores; continuous slickensides along ped surfaces; calcareous, moderately alkaline (pH 8.0) ; clear, wavy boundary. (10 to 16 inches thick.)

Cca—34 to 44 inches, light-gray (10YR 7/2) clay, light brownish gray (10YR 6/2) moist; massive; very hard, very firm, sticky and plastic; common very fine interstitial and tubular pores; calcareous; moderately alkaline (pH 8.0) ; clear, irregular boundary. (8 to 16 inches thick.)

R—44 inches, light-gray, calcareous, fractured shale.

The A horizon is commonly dark grayish brown, but in places it is dark brown or grayish brown. Its texture ranges from heavy clay loam to clay but it is commonly clay. Reaction is neutral to moderately alkaline. The Cca horizon is light gray, pale brown, or light yellowish brown to olive brown. Depth to lime in places is 10 inches or more, but the average depth is 30 to 40 inches. When this soil is dry, deep cracks develop that average ½ to 1½ inches in width and extend to an average depth of about 36 inches. Depth to bedrock ranges from 30 to 56 inches.

Included with this soil in mapping are small areas of Azule clay loam and Diablo clay, a few areas where lime is absent, and small areas of reddish-brown clay.

This soil has an available water holding capacity of 4 to 8 inches. Permeability is slow. Runoff is rapid, and the hazard of erosion is high. Natural fertility is high. Effective rooting depth is deep.

This soil is used for range. Capability unit VIe–5 (15); range site, Clayey.

Altamont clay, 15 to 30 percent slopes (AcE).—This soil has a profile that is similar to that of Altamont clay, 30 to 50 percent slopes.

Included with this soil in mapping are small areas of Diablo clay and areas subject to moderate or severe sheet erosion.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is used mainly for dryland grain hay, pasture, and range. Capability unit IVe–5 (15); range site, Clayey.

Altamont clay, 50 to 75 percent slopes, eroded (AcG2).—This soil has a profile that is similar to that of Altamont clay, 30 to 50 percent slopes. Because of moderate sheet erosion, depth to bedrock is 25 to 35 inches and occasional rock outcrops are present.

Included with this soil in mapping are small areas of San Benito clay loam and Landslides, and areas where the lighter colored, calcareous substratum has been exposed by erosion.

Available water holding capacity is 3.5 to 4.5 inches. Effective rooting depth is moderately deep. The hazard of erosion is very high, and runoff is very rapid.

The soil is used for range. Capability unit VIIe–5 (15); range site, Clayey.

Arbuckle Series

The Arbuckle series consists of well-drained gravelly loams that have developed in alluvium from material derived from sedimentary rock. These soils are on old fans and terraces and have slopes of 0 to 9 percent. The vegetation, where these soils are not cultivated, is chiefly annual grasses and forbs, and there are a few, scattered, large oak trees. Elevation ranges from 200 to 800 feet. Average annual rainfall is 15 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days. Arbuckle soils are associated with the Pleasanton and San Ysidro soils.

In a representative profile, the surface layer is brown and pale-brown, medium acid and slightly acid gravelly loam about 10 inches thick. The subsoil is brown and yellowish-brown, slightly acid, gravelly loam about 30 inches thick. The substratum is brown, slightly acid very gravelly sandy loam that extends to a depth of more than 60 inches. In some places the subsoil is underlain by shale bedrock at a depth of 38 to 50 inches, and the surface layer is loam.

Arbuckle soils are used for irrigated row crops, orchards, dryland grain hay, and pasture.

Arbuckle gravelly loam, 0 to 2 percent slopes (ArA).—This soil has an average slope of less than 2 percent.

Representative profile (1.75 miles east on Dunn Avenue from Southern Pacific Railroad crossing and 200 yards north in field; NW¼SE¼ sec. 22, T. 9 S., R. 3 E.):

Ap—0 to 6 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 4/3) moist; massive; hard, very friable, nonsticky and nonplastic; many very fine roots; many fine interstitial pores and few fine tubular pores; medium acid (pH 6.0); clear, smooth boundary. (4 to 7 inches thick.)

A1—6 to 10 inches, pale-brown (10YR 6/3) gravelly loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; many fine interstitial pores and few fine tubular pores; slightly acid (pH 6.1); gradual, wavy boundary. (4 to 6 inches thick.)

B1—10 to 20 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 4/3) moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and plastic; few very fine roots; many fine interstitial pores and few fine and medium tubular pores; few thin clay films in pores and on ped faces; slightly acid (pH 6.5); gradual, smooth boundary. (8 to 12 inches thick.)

B2t—20 to 32 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 4/3) moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and plastic; few very fine roots; many very fine interstitial and tubular pores; many thin clay films in pores and on ped surfaces; slightly acid (pH 6.5); gradual, smooth boundary. (10 to 12 inches thick.)

B3—32 to 40 inches, yellowish-brown (10YR 5/4) gravelly loam, dark yellowish-brown (10YR 4/4) moist; weak, medium, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores and few fine tubular pores; common thin clay films bridging mineral grains; slightly acid (pH 6.5); clear, smooth boundary. (8 to 10 inches thick.)

IIC—40 to 60 inches, brown (10YR 5/3) very gravelly sandy loam, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; slightly acid (pH 6.5).

The A horizon ranges from brown to light brownish gray and pale brown. Its texture is commonly gravelly loam but in places is gravelly fine sandy loam or gravelly sandy loam. Content of gravel is 15 and 35 percent by volume. Texture of the B2t horizon ranges from loam to gravelly sandy clay loam. Reaction is medium acid to neutral in the A and B horizons.

Included with this soil in mapping are small areas of San Ysidro loam and Pleasanton loam.

The available water holding capacity is about 5 to 7 inches. Permeability in the subsoil is moderate. Runoff is very slow and the hazard of erosion is none to slight. Fertility is moderate. Effective rooting depth is very deep.

This soil is used for irrigated row crops, prunes, apricots, walnuts, and dryland grain hay. Capability unit IIs–4 (14).

Arbuckle loam, deep, 5 to 9 percent slopes (AkC).—This soil is on old stream benches near stream channels in the Isabel Valley area. A few acres of this soil are undulating, but most of it has smooth slopes that average about 5 percent. The surface layer averages less than 15 percent gravel by volume. Shale bedrock is at a depth of 38 to 50 inches.

Included with this soil in mapping are small areas of Hillgate silt loam, a few areas of soils that have slopes up to 12 percent, and some areas that have a calcareous substratum.

Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water holding capacity is about 5.5 to 7.5 inches. Effective rooting depth is deep to shale.

This soil is used for dryland grain hay and pasture. Capability unit IIIe–1 (15).

Azule Series

The Azule series consists of well-drained clay loams that are underlain by semiconsolidated sediments. These soils have slopes of 9 to 75 percent and are on uplands. The vegetation, when these soils are not cultivated, is chiefly annual grasses and forbs, but a few areas have an oak-grass or brush cover. Elevation ranges from 500 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is about 200 to 250 days. Azule soils are associated with the Altamont, Montara, and Hillgrate soils.

In a representative profile, the surface layer is dark grayish-brown, medium acid clay loam about 12 inches thick. The subsoil is brown and yellowish-brown, medium acid gravelly sandy clay. It is underlain at a depth of 48 inches by light yellowish-brown, medium acid, soft sediments of gravelly sandy clay loam.

Azule soils are used for dryland orchards, vineyards, grain hay, pasture, range, wildlife, and watershed.

Azule clay loam, 30 to 75 percent slopes (AuG).—This soil is on hills along the eastern edge of the Santa Clara Valley. The average slopes range from 50 to 60 percent.

Representative profile (200 yards up, on hillside east of New Avenue, 1 mile east of Foothill Avenue intersection; NE¼SE¼ sec. 6, T. 10 S., R. 4 E.):

A1—0 to 12 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, sticky and plastic; common very fine roots; many very fine interstitial pores, many fine tubular pores, and few medium tubular pores; medium acid (pH 6.0); clear, wavy boundary. (6 to 14 inches thick.)

B2t—12 to 28 inches, brown (7.5YR 5/4) gravelly sandy clay, dark brown (7.5YR 4/4) moist; weak, coarse, columnar structure parting to moderate, coarse and medium, subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; many very fine interstitial pores and common fine tubular pores; many, thin and common, moderately thick clay films on ped surfaces and in pores; medium acid (pH 6.0); clear, smooth boundary. (12 to 20 inches thick.)

B3t—28 to 48 inches, variegated yellowish-brown (10YR 5/4) and brown (7.5YR 5/4) gravelly sandy clay, dark yellowish brown (10YR 4/4) and dark brown (7.5YR 4/4) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; many very fine interstitial pores and common very fine tubular pores; continuous, thin clay films on ped surfaces and in pores; medium acid (pH 6.0); gradual, smooth boundary. (12 to 24 inches thick.)

C—48 to 60 inches, light yellowish-brown (10YR 6/4) gravelly sandy clay loam, yellowish brown (10YR 5/4) moist; massive; hard, very friable, slightly sticky and slightly plastic; many very fine interstitial pores; common, thin, brown (7.5YR 5/4) colloid stains on mineral grains; medium acid (pH 6.0).

The A horizon is dark grayish brown, grayish brown, or dark gray. Reaction is neutral to medium acid. Texture is commonly clay loam but ranges to silt loam or gravelly clay. The B horizon is brown to yellowish brown or grayish brown. Reaction is medium acid to neutral. Texture is normally gravelly sandy clay but ranges from gravelly clay to heavy clay loam. Depth to the C horizon ranges from 30 to 58 inches. Very few roots reach this horizon, but it is not impervious. Seams of lime are present in a few places.

Included with this soil in mapping are small areas of Altamont clay along ridge crests and toe slopes, areas of Hillgate silt loam, small landslips, and a few areas that are severely gullied.

Available water holding capacity is about 8 to 9 inches. Permeability in the subsoil is slow. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. Natural fertility is high. Effective rooting depth is very deep.

This soil is used for range, wildlife, and watershed. Capability unit VIIe-1 (15); range site, Fine Loamy.

Azule clay loam, 9 to 15 percent slopes, eroded (AuD2).—This soil is strongly sloping on ridgetops, toe slopes, or benches, and it is geographically associated with Hillgate soils. Average slope is about 12 percent. Texture is normally clay loam, but it ranges to silty clay. Sheet erosion is moderate, and 2 to 6 inches of the surface layer has been lost.

Included with this soil in mapping are small areas of Hillgate silty loam, small areas of soils that have a gravelly clay loam surface layer, and areas that have been subject to severe sheet and rill erosion.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used for dryland prunes, grapes, grain hay, and pasture. Capability unit IIIe-3(15).

Azule clay loam, 15 to 30 percent slopes (AuE).—This soil is on broad, rounded ridgetops and is moderately steep on rounded hills. Average slope is 25 percent.

Included with this soil in mapping are small areas of Hillgate silt loam and a few deeply cut gullies.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is used for dryland pasture and range. Capability unit IVe-3(15); range site, Fine Loamy.

Azule clay loam, 15 to 30 percent slopes, eroded (AuE2).—This soil is moderately steep on ridgetops and toe slopes. It has an average slope of about 25 percent. Two to 6 inches of the surface layer has been removed by erosion.

Included with this soil in mapping are small areas of Hillgate silt loam, areas of soils that have a gravelly clay loam surface layer, and areas that have been subject to severe sheet and rill erosion or are severely gullied.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is used for dryland prunes, vineyards, grain hay, and pasture. Capability unit IVe-3(15); range site, Fine Loamy.

Azule clay loam, 30 to 75 percent slopes, eroded (AuG2).—This soil has a profile that is similar to that of Azule clay loam, 30 to 75 percent slopes, except that 2 to 4 inches of the surface layer has been removed by erosion. This soil is steep and very steep and in broad areas on the hills along the eastern edge of the Santa Clara Valley. On the average, slopes range from 50 to 60 percent. Color is dominantly grayish brown, but in a few places it is brown or pale brown.

Included with this soil in mapping are some areas of Hillgate silt loam that have been subject to severe sheet and rill erosion, landslips, and gullied land.

The available water holding capacity is 7 to 8 inches.

This soil is used for range, wildlife, and watershed. Capability unit VIIe-1 (15); range site, Fine Loamy.

Ben Lomond Series

The Ben Lomond series consists of well-drained fine sandy loams that are underlain by soft sandstone at a depth of 33 to 60 inches. These soils have slopes of 50 to 75 percent and are on uplands. Vegetation is coniferous forest consisting mainly of redwood and Douglas-fir but including associated hardwoods. Elevation ranges from 500 to 2,200 feet. Average annual rainfall is 35 to 50 inches, and average annual temperature is 55° to 56° F. The growing season is 200 to 250 days. Ben Lomond soils are associated with the Felton and Madonna soils.

In a representative profile, a 2-inch litter of fresh and decomposed needles and leaves overlies a mineral surface layer of dark grayish-brown, slightly acid fine sandy loam about 6 inches thick. The subsoil is dark-brown, brown, and light-brown, medium acid to strongly acid fine sandy loam and very fine sandy loam. It is underlain at a depth of 43 inches by very pale brown, strongly acid, soft sandstone.

Ben Lomond soils are used for recreation, wildlife, and watershed. A few areas are used for timber production.

Ben Lomond fine sandy loam, 50 to 75 percent slopes (BeG).—This soil is very steep.

Representative profile (on east-facing slope 800 feet northeast of old Watsonville Road, 0.8 mile northeast of intersection with Loop Road; NE¼NE¼ sec. 35, T. 10 S., R. 2 E.):

O—2 inches to 0, fresh and partly decomposed redwood needles and other forest litter; abrupt, smooth boundary. (1 to 4 inches thick.)

A1—0 to 6 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; strong, medium and fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine roots, and few medium roots; many very fine interstitial pores; slightly acid (pH 6.5); clear, smooth boundary. (4 to 10 inches thick.)

B1—6 to 15 inches, dark-brown (7.5YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak, medium and fine, subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine, medium, and coarse roots; many very fine interstitial pores and common fine and medium tubular pores; medium acid (pH 6.0); clear, wavy boundary. (8 to 10 inches thick.)

B2—15 to 27 inches, brown (7.5YR 5/4) very fine sandy loam, dark brown (7.5YR 3/2) moist; weak, medium and fine, subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine roots and few medium and coarse roots; many very fine interstitial pores and common fine and medium tubular pores; medium acid (pH 6.0); clear, wavy boundary. (11 to 20 inches thick.)

B3—27 to 43 inches, light-brown (7.5YR 6/4) very fine sandy loam, dark brown (7.5YR 4/4) moist; weak, medium, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine and coarse roots and many medium roots; many very fine interstitial pores and fine tubular pores and few medium and coarse tubular pores; strongly acid (pH 5.5); clear, wavy boundary. (10 to 20 inches thick.)

C—43 to 60 inches, very pale brown (10YR 7/4) soft sandstone that is easily cut by hand tools, yellowish brown (10YR 5/4) moist; massive; strongly acid (pH 5.5).

The A horizon is commonly dark grayish brown or grayish brown, but in places it is dark brown. Texture is generally fine sandy loam to light loam. Depth to soft sandstone ranges from 33 to 60 inches.

Included with this soil in mapping are small areas of Felton, Los Gatos, and Maymen soils.

The available water holding capacity is 5 to 9 inches. Natural fertility is moderate. Permeability in the subsoil is moderately rapid. Runoff is very rapid, and the hazard of erosion is very high. Effective rooting depth is deep to soft sandstone.

This soil is used mainly for recreation, wildlife, and watershed. A few areas are used for timber production. The very steep slopes create a hazard of erosion where areas are logged. This soil is moderately productive, and the average site index is 120 (*3*). Hazard of windthrow is slight. Plant competition and seedling mortality are moderate. Capability unit VIIe–1 (4).

Campbell Series

The Campbell series consists of somewhat poorly drained, silty clay loams that have developed in alluvium from material derived from sedimentary rock. These soils have slopes of less than 2 percent and are on low valley bottoms and alluvial plains. The vegetation, where these soils are not cultivated, is chiefly annual grasses, perennial grasses, and forbs. Elevation ranges from 130 to 300 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is about 58° to 60° F. The growing season is about 250 to 275 days. Campbell soils are associated with the Yolo and Clear Lake soils.

In a representative profile, the surface layer is dark-gray, mildly alkaline and moderately alkaline silty clay loam about 40 inches thick. It is mottled, slightly calcareous, and moderately alkaline below 27 inches. The substratum is light olive-brown, mottled, calcareous, moderately alkaline silty clay loam and extends to a depth of 60 inches or more. In some places the substratum is clay or muck. In other places the surface layer is silty clay.

The Campbell soils are used for irrigated row crops, sugar beets, orchards, and hay.

Campbell silty clay loam (Ca).—This soil is nearly level and has less than 1 percent slope.

Representative profile (in first row of trees on south side of road, in orchard 0.5 mile west on Laguna Avenue from Southern Pacific Railroad tracks; NW¼SW¼ sec. 35, T. 8 S., R. 2 E.):

Ap—0 to 8 inches, dark-gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; massive; hard, friable, slightly sticky and plastic; common fine and very fine roots; many fine and very fine interstitial pores and few fine and very fine tubular pores; mildly alkaline (pH 7.5); abrupt, smooth boundary. (6 to 8 inches thick.)

A11—8 to 27 inches, dark-gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; massive; hard, friable, slightly sticky and plastic; few fine roots and common medium roots; many very fine and fine interstitial pores, many very fine and fine tubular pores, and a few medium tubular pores; mildly alkaline (pH 7.5); gradual, smooth boundary. (16 to 20 inches thick.)

A12—27 to 40 inches, dark-gray (5Y 4/1) silty clay loam, very dark gray (5Y 3/1) moist; common, fine, distinct, light olive-brown (2.5Y 5/4) mottles, olive brown (2.5Y 4/4) moist; weak, medium and fine, subangular blocky structure; hard, friable, slightly sticky and plastic; few, very fine, fine, and medium roots; many very fine and fine tubular pores and few medium tubular pores; slightly calcareous, moderately alkaline (pH 8.0); diffuse, smooth boundary. (12 to 15 inches thick.)

C—40 to 68 inches, light olive-brown (2.5Y 5/4) silty clay loam, olive brown (2.5Y 4/4) moist; common, fine, faint, light yellowish-brown (10YR 6/4) mottles, dark yellowish brown (10YR 4/4) moist, and few very thin bands of light gray (10YR 6/1), gray (10YR 5/1) moist; massive; hard, friable, slightly sticky and plastic; few, very fine, fine, and medium roots; many very fine and fine tubular pores and few medium tubular pores; slightly calcareous, moderately alkaline (pH 8.0).

The A horizon color is commonly dark gray but in places is dark grayish brown or grayish brown. Texture is silty clay loam or clay loam. The C horizon in places is light olive brown, light brownish gray, or grayish brown and contains common to many, fine to medium, light yellowish-brown to light-gray mottles. Texture is dominantly silty clay loam but in places is stratified silty clay. Secondary lime accumulations lies at an average depth of 30 inches but occasionally are below a depth of 60 inches.

Included with this soil in mapping are some areas of Clear Lake clay and Yolo silty clay loam.

Drainage of these soils has been improved as the water table has been lowered by pumping and by the natural deepening of drainageways. Available water holding capacity is 11 to 12 inches. Permeability is moderately slow. Runoff is very slow, and the hazard of erosion is none to slight. Natural fertility is high. Effective rooting depth is very deep.

This soil is used for irrigated row crops, sugar beets, prunes, walnuts, apricots, and pears. Capability unit I–1 (14).

Campbell silty clay loam, clay substratum (Cc).—This soil is in small to medium-sized areas south of Pacheco Pass Highway, just east of Miller Slough, and it may be flooded about once every 10 years. The surface layer is silty clay loam, clay loam, or silty clay. The color ranges from dark gray to dark grayish brown, and mottling occurs just below a depth of 18 inches. The substratum at an average depth of 36 inches is dark gray clay. The water table is at a depth of 36 to 60 inches.

Included with this soil in mapping are areas of gravelly clay loam and areas where depth to very dark gray clay is only 20 inches.

Available water holding capacity is 10 to 11 inches. Permeability is slow. Effective rooting depth is restricted by the seasonal water table.

This soil is used for irrigated row crops and sugar beets. Capability unit IIIw-5 (14).

Campbell silty clay (Cd).—The upper 8 inches of this soil is a silty clay, but otherwise it has a profile similar to that of Campbell silty clay loam. Areas of this soil are flooded about once every 5 years.

Included with this soil in mapping are small areas of Clear Lake clay and areas of soils that have a calcareous surface layer. Also included are some areas that have about 6 percent medium and fine gravel in the surface layer.

This soil is used for irrigated row crops, sugar beets, prunes, walunts, apricots, and pears. Capability unit IIs–5 (14).

Campbell silty clay, muck substratum (Ce).—The surface layer of this soil consists mainly of silty clay but is clay loam in places. Color is dark gray, dark grayish brown, or grayish brown. Mottling occurs below a depth of 18 inches. The substratum, at an average depth of 38 inches, consists of about 70 percent mucky material and 30 percent gleyed clay. When the levees along Llagas Creek break, resultant flooding may cause deposition.

Included with this soil in mapping are areas of a grayish-brown clay loam that is 3 to 15 inches thick over dark-gray silty clay loam, areas of soils that are calcareous in the surface layer, and areas of soils that contain slight concentrations of neutral salts.

Permeability is slow. The available water holding capacity is 12 to 13 inches. Effective rooting depth is restricted by a seasonal water table at a depth of 30 to 40 inches.

This soil is used for irrigated row crops and sugar beets. Capability unit IIIw–5 (14).

Clear Lake Series

The Clear Lake series consists of poorly drained clays that have developed in alluvium from material derived from sedimentary sources. These soils have slopes of less than 2 percent and lie on low alluvial plains. The vegetation, where these soils are not cultivated, is chiefly annual grasses, perennial grasses, and forbs. Elevation ranges from 130 to 300 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is about 58° to 60° F. The growing season is about 250 to 275 days. Clear Lake soils are associated with Campbell and Yolo soils.

In a representative profile, the surface layer is dark-gray, neutral clay about 26 inches thick. The substratum is mottled, grayish-brown, calcareous, moderately alkaline clay to a depth of 60 inches or more. Some areas are drained, and in a few places there are slight concentrations of salts.

Clear Lake soils are used for irrigated row crops, orchards, and dryland grain hay.

Clear Lake clay, drained (Ch).—This soil has slopes of less than 2 percent and lies on low alluvial plains.

Representative profile (400 feet southwest of Hale and Palm Avenue intersection, north of Morgan Hill):

Ap—0 to 6 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong, fine, granular structure; hard, friable, sticky and plastic; many very fine roots; many very fine interstitial and tubular pores; neutral (pH 7.0); clear, smooth boundary (4 to 7 inches thick.)

A1—6 to 26 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, coarse and medium, prismatic structure; very hard, firm, sticky and plastic; common very fine roots; many very fine interstitial and tubular pores; common slickensides on prism faces, and common vertical cracks ¼ to ½ inch wide when dry; neutral (pH 7.0); clear, wavy boundary. (18 to 22 inches thick.)

C1—26 to 36 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; many, fine, faint, light olive-brown (2.5Y 5/4) mottles, olive brown (2.5Y 4/4) moist; strong, coarse, prismatic structure; extremely hard, firm, sticky and plastic; few very fine roots; many very fine interstitial and tubular pores; common slickensides on prism faces, and common vertical cracks ¼ to ½ inch wide when dry; slightly calcereous, moderately alkaline (pH 8.0); clear, wavy boundary. (10 to 20 inches thick.)

C2ca—36 to 60 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; many, fine, distinct yellowish-brown (10YR 5/4) mottles, dark yellowish-brown (10 YR 4/4) moist; massive; very hard, firm, sticky and plastic; many very fine interstitial and tubular pores; moderately calcareous, moderately alkaline (pH 8.0).

The A horizon is dark gray or very dark gray. Reaction ranges from neutral to moderately alkaline. The C horizon in places is grayish brown, olive brown, or olive mixed with many, fine, faint, light olive-brown to distinct yellowish-brown mottles. Lime accumulations generally occur within the C horizon, but the lower part of the horizon is not calcareous in all places. When this soil is dry, deep cracks develop in the A horizon and the upper part of the C horizon that average from ¼ to 1½ inches in width.

Included with this soil in mapping are areas of grayish-brown clay loam that is 10 to 20 inches deep over the original dark-gray clay surface layer as a result of land leveling or deposition of overwash material. There are also small areas of Campbell silty clay loam and Sunnyvale silty clay.

Available water holding capacity is 8 to 10 inches. Permeability is slow. Runoff is very slow, and the hazard of erosion is none to slight. Depth to water table is more than 60 inches because of the general lowering of the ground water level in the valley as a result of pumping and stream cutting. Effective rooting depth is very deep. Natural fertility is high.

This soil is used for irrigated row crops, prunes, walnuts, apricots, pears, and dryland grain hay. Capability unit IIs–5(14).

Clear Lake clay (Cg).—This soil has a profile that is similar to that of Clear Lake clay, drained, but it has a seasonal water table at a depth of 30 to 48 inches. It is more difficult to drain, and drainage systems are more difficult to maintain. Elevations are lower, and drainage outlets are not practical. Flooding occurs about once every 5 years along Llagas Creek, Pajaro River, and Fisher Creek.

Included with this soil in mapping are a few areas that are slightly calcareous in the surface layer. About 50 percent of this soil has a buried horizon of very dark gray clay. In a few places, at a depth of more than 40 inches, the substratum is loamy sand.

Available water holding capacity is 8 to 10 inches. Effective rooting depth is restricted by the seasonal water table.

This soil is used for irrigated row crops and pears. Capability unit IIIw–5 (14).

Clear Lake clay, saline (Ck).—This soil has a profile that is similar to that of Clear Lake clay, drained, but the surface layer contains slight concentrations of salts. Drainage is more difficult to provide and maintain because the soil is at elevations lower than the drainage channels. Flooding occurs about once every 5 years.

Included with this soil in mapping are small areas of Willows clay and areas that are calcareous in the surface layer.

Because of the salts in this soil, available water holding capacity is about 6 to 8 inches. Effective rooting depth is restricted by a seasonal water table at a depth ranging from 30 to 48 inches. Fertility is moderate.

This soil is used mainly for dryland pasture. A few areas are used for irrigated row crops. Capability unit IIIw–5 (14).

Climara Series

The Climara series consists of well-drained stony clays that are underlain by metamorphosed basic igneous rock at a depth of 20 to 40 inches. These soils are on the uplands and have slopes of 9 to 50 percent. Vegetation is mainly annual grasses and a few scattered oaks. Elevation ranges from 500 to 2,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is about 200 to 250 days. Climara soils are associated with the Azule and Montara soils.

In a representative profile, the surface layer is a dark-gray, neutral stony clay and clay about 19 inches thick. In some places there are no stones on the surface. The substratum is dark grayish-brown, calcareous, moderately alkaline clay underlain at a depth of 27 inches by calcareous, hard metamorphosed basic igneous rock.

Climara soils are used for dryland pasture and range.

Climara stony clay, 15 to 50 percent slopes (CmE).—This soil has slopes that average about 30 percent.

Representative profile (on Roop Road 0.5 mile from the intersection with New Avenue; NW¼NW¼ sec. 22, T. 10 S., R. 4 E.):

A11—0 to 5 inches, dark-gray (10YR 4/1) stony clay, very dark gray (10YR 3/1) moist; strong, medium and fine, granular structure; hard, friable, sticky and plastic; many very fine roots; many very fine insterstitial and tubular pores; neutral (pH 7.0); clear, smooth boundary. (5 to 12 inches thick.)

A12—5 to 19 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, coarse, angular blocky structure; very hard, firm, sticky and plastic; few very fine roots; many very fine interstitial and tubular pores; few slickensides on ped surfaces, and few vertical cracks ¼ to ½ inch wide when dry; neutral (pH 7.0); clear, irregular boundary. (8 to 18 inches thick.)

Cca—19 to 27 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; strong, coarse, prismatic structure; extremely hard, firm, sticky and plastic; few fine roots; many very fine interstitial and tubular pores; many slickensides on prism faces, and many vertical cracks ¼ to ½ inch wide when dry; slightly calcareous, moderately alkaline (pH 8.0); clear, wavy boundary. (7 to 10 inches thick.)

R—27 inches, calcareous, hard, metamorphosed basic igneous rock.

The A horizon is dark gray or gray. Texture is typically clay but ranges to heavy clay loam. Reaction is neutral to moderately alkaline. The C horizon is grayish brown or dark grayish brown. Depth to bedrock is typically 27 inches but ranges from 20 to 40 inches. About 0.01 to 0.1 percent of the surface area is covered by stones.

Included with this soil in mapping are small areas of Montara rocky clay loam along the ridge crests and fault lines, a few areas of soils that are calcareous in the surface layer, a few eroded areas that have numerous gullies, and areas of rock outcrops.

This soil has an available water holding capacity of 3 to 7 inches. Permeability is slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Natural fertility is moderate. Effective rooting depth is moderately deep.

This soil is used for range. Capability unit VIe–5 (15); range site, Clayey.

Climara clay, 9 to 30 percent slopes (ClD).—This soil has a profile that is similar to that of Climara stony clay, 15 to 50 percent slopes, but it has less than 0.01 percent stones on the surface. It is on rounded ridgetops or in small, less sloping areas near the steeper Climara soils. The average slope is about 15 percent.

Included with this soil in mapping are small areas of Montara rocky clay loam, severely eroded areas, small landslips, and gullied land.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used for dryland pasture and range. Capability unit IVe-5 (15); range site, Clayey.

Cortina Series

The Cortina series consists of somewhat excessively drained, very gravelly loams that are underlain by alluvium from mixed sources. These soils are on stream benches along major drainageways and have slopes of 0 to 5 percent. Vegetation, where these soils are not cultivated, is grasses, forbs, brush, and scattered sycamore and oak trees. Elevation ranges from 100 to 2,400 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is about 250 to 275 days. Cortina soils are associated with the Esparto and Yolo soils.

In a representative profile, the surface layer is pale-brown and brown, slightly acid very gravelly loam and very gravelly fine sandy loam about 28 inches thick. The substratum is pale-brown, slightly acid very gravelly sandy loam to a depth of 60 inches or more.

Cortina soils are used mainly for dryland pasture. A few areas are used for irrigated prunes.

Cortina very gravelly loam, 0 to 5 percent slopes (CoB).—This nearly level to gently sloping soil is on stream benches along major drainageways. It is subject to overflow from adjacent streams.

Representative profile (100 yards south of Isabel Valley Ranch gate on road to China Grade; SW¼SE¼ sec. 14, T. 7 S., R. 4 E.):

A1—0 to 8 inches, pale-brown (10YR 6/3) very gravelly loam containing 60 percent (by volume) medium and fine gravel, dark brown (10YR 4/3) moist; massive; hard, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; slightly acid (pH 6.5); clear, smooth boundary. (8 to 12 inches thick.)

IIAb—8 to 28 inches, brown (10YR 5/3) very gravelly fine sandy loam containing 80 percent (by volume) medium and fine gravel, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many very fine interstitial pores and common fine and few medium tubular pores; slightly acid (pH 6.5); abrupt, smooth boundary. (20 to 30 inches thick.)

IIC—28 to 60 inches, pale-brown (10YR 6/3) very gravelly sandy loam containing 90 percent (by volume) medium and fine gravel, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many very fine interstitial pores, common fine tubular pores, and few medium tubular pores; slightly acid (pH 6.5).

The A horizon ranges from brown to grayish brown, pale brown, or light brownish gray. Reaction is slightly acid to neutral in both the A and C horizons. Texture is sandy loam, fine sandy loam, or loam, and these horizons are gravelly or very gravelly. At a depth of 12 to 40 inches, both the A and C horizons are very gravelly sandy loam to very gravelly loam. These soils are subject to flooding, washout, or channeling about three times every 10 years.

Included with this soil in mapping are small areas of Riverwash and Garretson gravelly loam, and small areas that have no gravel in the upper few inches of the surface layer.

This soil has low natural fertility, and available water holding capacity is 2.5 to 4 inches. Permeability is rapid. Runoff is very slow. Effective rooting depth is very deep, but root density is limited by the droughty, very gravelly substratum.

This soil is used mostly for dryland pasture, wildlife, and recreation. A few areas are used for irrigated prunes. Capability units IVw-4 (14) and VIw-4 (15).

Cropley Series

The Cropley series consists of well-drained clays that are underlain by alluvium from mixed sources. These soils lie on fans and terraces and have slopes of 0 to 9 percent. Vegetation, where these soils are not cultivated, is annual grasses, perennial grasses, and forbs. Elevation ranges from 130 to 1,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is about 58° to 60° F. The growing season is about 260 to 275 days. Cropley soils are associated with the Clear Lake and Pleasanton soils.

In a representative profile, the surface layer is very dark gray, neutral to mildly alkaline clay about 36 inches thick. The substratum is a dark grayish-brown, calcareous, moderately alkaline clay to a depth of 60 inches or more. When these soils are dry, deep cracks develop. Slickensides that intersect are present in the surface layer and in the upper part of the substratum.

Cropley soils are used for irrigated row crops, orchards, dryland grain hay, and pasture.

Cropley clay, 0 to 2 percent slopes (CrA).—This soil averages about 1 percent slope and occupies alluvial fans.

Representative profile (in a field 0.2 mile south of Foothill Road from Tennant Avenue intersection and 0.1 mile east):

Ap—0 to 7 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak, medium, subangular blocky structure and strong, medium and fine, granular structure; very hard, very firm, very sticky and very plastic; many very fine roots; many fine and very fine interstitial pores and few medium tubular pores; neutral (pH 7.0); clear, smooth boundary. (5 to 10 inches thick.)

A11—7 to 14 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; strong, coarse, prismatic structure; very hard, very firm, very sticky and very plastic; few very fine roots and few coarse woody roots; common very fine interstitial pores and few fine tubular pores; small, numerous slickensides on ped surfaces; neutral (pH 7.0); gradual, wavy boundary. (7 to 12 inches thick.)

A12—14 to 36 inches, very dark gray (10YR 3/1) to dark-gray (10YR 4/1) clay, black (10YR 2/1) and very dark gray (10YR 3/1) moist; coarse, strong, prismatic structure; very hard, very firm, very sticky and very plastic; few fine interstitial pores and fine tubular pores; numerous slickensides and pressure cutans on ped surfaces; mildly alkaline (pH 7.5); gradual, wavy boundary. (15 to 30 inches thick.)

Cca—36 to 60 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; massive; hard, firm, sticky and plastic; many, very fine, interstitial pores and common, very fine, tubular pores; calcareous, moderately alkaline (pH 8.0).

The A horizon ranges from dark gray to very dark gray and nearly black. Texture is typically clay but in places is heavy clay loam. Segregated lime is at a depth ranging from 20 to 60 inches but commonly is at about 36 inches. The C horizon is dark grayish brown, grayish brown, or brown. Texture is stratified clay and silty clay loam that averages clay to a depth of more than 40 inches. When this soil is dry, deep cracks develop that range from ½ to 1½ inches in width and extend to an average depth of 36 inches.

Included with this soil in mapping are small areas of Clear Lake clay in low depressions and areas of gravelly clay loam overwash that ranges from 12 to 30 inches in thickness.

The available water holding capacity is 8.5 to 10 inches. Permeability is slow. Runoff is very slow, and the erosion hazard is none to slight. Fertility is high. Effective rooting depth is very deep.

This soil is used for irrigated prunes, apricots, pears, walnuts, row crops, sugar beets, dryland hay, and pasture. Capability unit IIs-5 (14).

Cropley clay, 2 to 9 percent slopes (CrC).—This soil has a profile that is similar to that of Cropley clay, 0 to 2 percent slopes, but slopes average 6 percent.

Included with this soil in mapping are soils that have a gravelly heavy clay loam or gravelly clay texture in the surface layer.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for irrigated prunes, pears, apricots, walnuts, row crops, dryland hay, and pasture. Capability unit IIe-5 (14).

Diablo Series

The Diablo series consists of well-drained clays that are underlain by fine-grained sandstone at a depth of 26 to 56 inches. These soils are on the uplands and have slopes of 9 to 50 percent. The vegetation, where these soils are not cultivated, is annual grasses and a few scattered oak trees. Elevation ranges from 400 to 2,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is about 250 to 275 days. Diablo soils are associated with the Azule and Los Osos soils.

In a representative profile (fig. 3), the surface layer is very dark gray and dark gray, mildly alkaline and moderately alkaline clay about 30 inches thick. The substratum is olive-gray, calcareous, moderately alkaline clay that is underlain at a depth of 40 inches by light olive-gray, soft, calcareous, moderately alkaline, fine-grained sand- soft, calcareous, moderately alkaline, fine-grained sandstone.

Diablo soils are used for dryland grain hay, pasture, and range.

Diablo clay, 9 to 15 percent slopes (DaD).—This soil is on uplands. Average slope is about 12 percent.

Representative profile (1,400 feet up jeep trail off East Fork Coyote Creek toward Rock House Ridge; SW¼NE¼ sec. 31, T. 8 S., R. 5 E.):

A11—0 to 2 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; strong, medium and fine, subangular blocky structure; very hard, very firm, sticky and very plastic; common fine roots; many very fine interstitial and tubular pores; mildly alkaline (pH 7.6); clear, smooth boundary. (1 to 3 inches thick.)

A12—2 to 20 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; strong, coarse, angular blocky structure; very hard, very firm, sticky and very plastic; few fine and medium roots; many very fine interstitial pores and few medium tubular pores; common slickensides on ped surfaces, and vertical cracks ¼ to ½ inch wide when dry; mildly alkaline (pH 7.6); clear, wavy boundary. (5 to 20 inches thick.)

A13ca—20 to 30 inches, dark-gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; strong, coarse, prismatic structure; very hard, very firm, sticky and very plastic; few medium roots; many very fine interstitial and tubular pores and few medium tubular pores; common slickensides on prism surfaces, and vertical cracks ¼ to ½ inch wide when dry; calcareous, moderately alkaline (pH 8.0); diffuse, wavy boundary. (10 to 13 inches thick.)

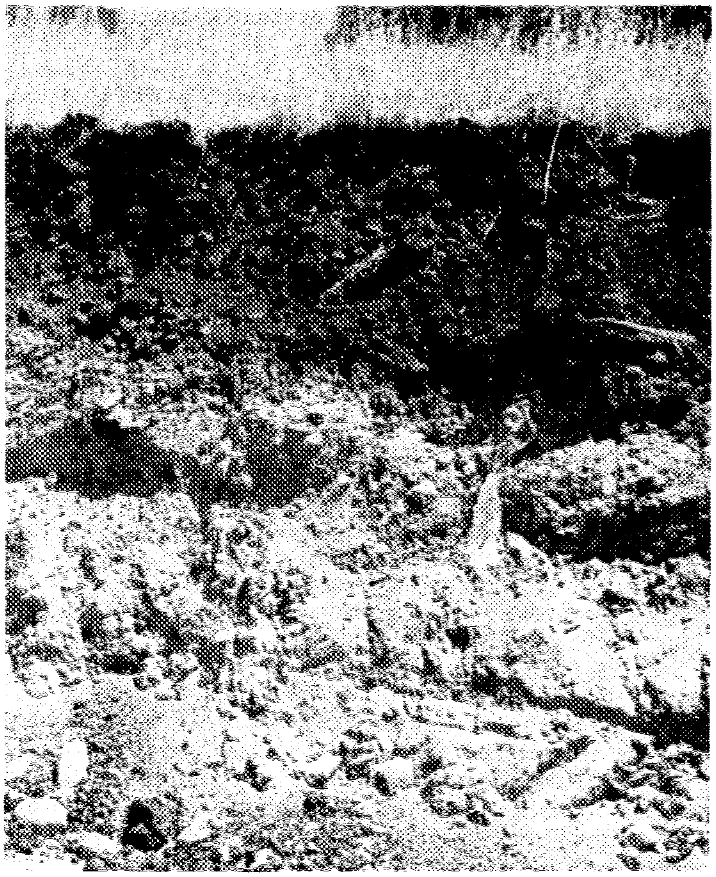

Figure 3.—Profile of Diablo clay, 9 to 15 percent slopes.

C—30 to 40 inches, olive-gray (5Y 5/2) clay, dark olive gray (5Y 3/2) moist; moderate, coarse, prismatic structure; very hard, very firm, sticky and very plastic; few medium and coarse roots; many very fine interstitial and tubular pores and few medium tubular pores; calcareous, moderately alkaline (pH 8.4); diffuse, wavy boundary. (10 to 20 inches thick.)

R—40 inches, light olive-gray, soft, calcareous, fine-grained sandstone.

The A horizon typically is clay but is heavy clay loam or silty clay in places. The C horizon in places is grayish brown, olive gray, or light olive gray. It is moderately calcareous to strongly calcareous and contains lime in soft masses and in seams. Lime is typically present in the lower part of the A horizon or the upper part of the C horizon, but in some places lime occurs at a depth of 10 to 50 inches. When this soil is dry, cracks averaging ¼ to 1½ inches in width develop and extend to an average depth of about 40 inches. Depth to bedrock ranges from 26 to 56 inches and averages about 40 inches.

Included with this soil in mapping are small areas of Climara clay, Los Osos clay loam, areas where lime is absent and the soils have a slightly acid surface layer, a few small areas of severely gullied land, and a few small landslips.

The available water holding capacity of this soil is 3 to 7 inches. Permeability is slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Fertility is high. Effective rooting depth is moderately deep to deep.

This Diablo soil is used for dryland grain hay, pasture, and range. Capability unit IIIe–5 (15) ; range site, Clayey.

Diablo clay, 30 to 50 percent slopes (DaF).—This soil has a profile similar to that of Diablo clay, 9 to 15 percent slopes.

Included with this soil in mapping are small areas that have been subject to moderate to severe sheet erosion, and areas where lime is absent. In a few areas are soils that have slopes of 15 to 30 percent.

Runoff is rapid, and the hazard of erosion is high.

This soil is used for pasture and range. Capability unit VIe–5 (15) ; range site, Clayey.

Esparto Series

The Esparto series consists of moderately well drained loams that are underlain by alluvium from material derived from sedimentary rocks. They lie on fans and stream benches and have slopes of 0 to 9 percent. The vegetation, where these soils are not cultivated, is annual grasses, forbs, and scattered large oak trees. Elevation ranges from 1,500 to 2,400 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days. Esparto soils are associated with the Gaviota and Yolo soils.

In representative profile, the surface layer is pale-brown, medium acid loam about 14 inches thick. The subsoil is a light brownish-gray and light yellowish-brown, slightly acid and neutral, light clay loam and silt loam about 34 inches thick. The substratum is mottled, brownish-yellow, neutral gravelly clay loam to a depth of 60 inches or more.

Esparto soils are used for dryland grain hay and pasture.

Esparto loam, 0 to 2 percent slopes (EsA).—This soil is level to nearly level.

Representative profile (in dryland pasture northeast of large dam on Isabel Valley Ranch; NW¼SE¼ sec. 16, T. 7 S., R. 4 E.) :

A1—0 to 14 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; massive; very hard, friable, nonsticky and nonplastic; many very fine roots; many very fine, interstitial pores, common fine tubular pores and few medium tubular pores; medium acid (pH 6.0) ; clear, wavy boundary. (10 to 16 inches thick.)

B2t—14 to 28 inches, light brownish-gray (10YR 6/2) light clay loam, dark grayish-brown (10YR 4/2) moist; moderate, medium, subangular blocky structure; very hard, friable, sticky and plastic; few very fine roots; many, very fine and fine tubular pores, few medium tubular pores, and few coarse tubular pores; continuous, thin clay films in pores and on ped surfaces; slightly acid (pH 6.5) ; gradual, wavy boundary. (12 to 20 inches thick.)

B3t—28 to 48 inches, light yellowish-brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) moist; many, fine, faint, dark-brown (10YR 4/3) mottles; weak, medium, subangular blocky structure; very hard, friable, nonsticky and nonplastic; many very fine tubular pores; common, thin clay films in pores and on ped surfaces; neutral (pH 7.0) ; clear, smooth boundary (18 to 22 inches thick.)

IIC—48 to 60 inches, brownish-yellow (10YR 6/6) gravelly clay loam (18 percent fine gravel), yellowish brown (10YR 5/6) moist; many, fine, distinct, light yellowish-brown (10YR 6/4) mottles, yellowish brown (10YR 5/8) moist; massive; very hard, friable, sticky and plastic; many very fine and fine tubular pores; neutral (pH 7.0.)

The A horizon ranges from light brownish gray to pale brown, and in a few areas it is grayish brown in the upper few inches. Reaction is slightly acid to medium acid and ranges to neutral in the B horizon. The B horizon is light brownish gray to light yellowish brown. Texture of the B horizon is typically light clay loam but ranges to loam or gravelly loam. Mottling starts in the lower part of the B horizon, and the contrast in colors increases with depth. The C horizon is mottled brownish yellow or very pale brown. In a few places lime occurs at a depth of more than 40 inches.

Included with this soil in mapping are small areas of Pleasanton loam and a few areas that have outcrops of rock.

The available water holding capacity is 10 to 12 inches. Permeability is moderately slow. Runoff is very slow, and the hazard of erosion is none to slight. This soil is moderately fertile. Effective rooting depth is very deep.

This soil is used for dryland grain hay and pasture. Capability unit IIIc–1 (15).

Esparto loam, 2 to 9 percent slopes (EsC).—This soil is on small fans that extend into narrow drainageways. Slope generally is about 5 percent. Texture is loam, and most profiles contain 2 to 3 percent medium and fine gravel.

Included with this soil in mapping are areas of gravelly loam and seepage spots along drainage channels.

Hazard of erosion is slight to moderate, and runoff is slow to medium.

This soil is used for dryland grain hay and pasture. Capability unit IIIe–1 (15).

Felton Series

The Felton series consists of well-drained silt loams that are underlain by interbedded shales and sandstone at a depth of 20 to 59 inches. These soils lie on uplands and have slopes of 15 to 75 percent. Where these soils have not been cleared for farming, vegetation is redwood, Douglas-fir, and associated hardwoods. Elevation ranges from 500 to 2,200 feet. Average annual rainfall is 40 to 50 inches, and average annual temperature is 55° to 56° F. The growing season is about 200 to 250 days. Felton soils are associated with the Ben Lomond, Madonna, and Los Gatos soils.

In a representative profile, the surface layer is brown, medium acid silt loam about 2 inches thick. The subsoil is brown, light-brown, and light yellowish-brown, medium acid and strongly acid clay loam about 37 inches thick. The substratum is light yellowish-brown, strongly acid, shaly clay loam about 9 inches thick over interbedded shale and sandstone.

Felton soils are used for dryland grain hay, pasture, range, timber, Christmas trees, recreation, and watershed.

Felton silt loam, 50 to 75 percent slopes (FaG).—This very steep soil is on the uplands.

Representative profile (1.9 miles above Sprig Lake on Watsonville Road, 200 yards uphill on old skid trail; SW¼NW¼ sec. 6, T. 11S., R. 3E.) :

O1—1 inch to 0, leaves, needles, and twigs, some partially decomposed; abrupt, smooth boundary. (1 to 2 inches thick.)

A1—0 to 2 inches, brown (7.5YR 5/2) silt loam, dark brown (7.5YR 3/2) moist; moderate, medium, subangular blocky structure, parting to medium and fine granular structure; slightly hard, friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial and tubular pores; medium acid (pH 6.0) ; clear, smooth boundary. (2 to 6 inches thick.)

B1t—2 to 10 inches, brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/2) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; common fine roots and few medium roots; many very fine interstitial and tubular pores; common thin clay films on ped surfaces and in pores; medium acid (pH 6.0); clear, wavy boundary. (4 to 9 inches thick.)

B2t—10 to 23 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; few fine roots and many medium and coarse roots; many very fine interstitial and tubular pores and few, fine, medium, and coarse tubular pores; many thin clay films lining pores and on ped surfaces; medium acid (pH 6.0); clear, wavy boundary. (10 to 14 inches thick.)

B3t—23 to 39 inches, light yellowish-brown (10YR 6/4) clay loam, yellowish brown (10YR 5/6) moist; moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; few medium and coarse roots; many very fine interstitial and tubular pores and few medium and coarse tubular pores; common, thin clay films lining pores and on ped surfaces; strongly acid (pH 5.5); gradual, wavy boundary. (10 to 18 inches thick.)

C1—39 to 48 inches, light yellowish-brown (10YR 6/4) shaly clay loam, about 25 percent (by volume) shale fragments ½ to 1 inch in diameter, yellowish brown (10YR 5/6) moist; weak, medium, subangular blocky structure; hard, firm, sticky and plastic; few medium and coarse roots; many very fine and fine tubular pores and few medium and coarse tubular pores; few thin clay films in pores and on ped surfaces; strongly acid (pH 5.5); gradual, wavy boundary. (9 to 12 inches thick.)

C2—48 inches, interbedded shale and sandstone mixed with yellowish-brown (10YR 5/6) clay loam, dark yellowish brown (10YR 4/4) moist; massive; strongly acid (pH 5.5).

The A horizon commonly is brown or grayish brown, but on concave slopes it is very dark grayish brown in the upper few inches. Texture is silt loam or light silty clay loam. Reaction is slightly acid to medium acid in the A horizon. The B horizon is brown or light brown in the upper part and ranges to very pale brown, light brown, light yellowish brown, and, in a few places, pinkish gray in the lower part. Texture is clay loam or silty clay loam. Depth to the C2 horizon of soft, fine-grained sandstone and shale ranges from 35 to 59 inches.

Included with this soil in mapping are small areas of Ben Lomond sandy loam and, along ridge crests, Madonna loam.

The available water holding capacity of this soil is 6 to 10 inches, depending on the depth of the soil. Permeability in the subsoil is moderately slow. Runoff is very rapid, and the hazard of erosion is very high. Natural fertility is moderate. Effective rooting depth is moderately deep to deep.

This soil is used mainly for timber production, recreation, and watershed. It is moderately productive; site index averages about 130 (*3*). Plant competition is moderate, equipment limitation is severe, seedling mortality is moderate, and windthrow hazard is slight. Capability unit VIIe-1 (4).

Felton silt loam, 15 to 30 percent slopes (FoE).—This soil is on the crests of broad ridges and on footslopes along drainageways. Depth to the substratum is 20 to 36 inches.

Included with this soil in mapping are small areas of Maymen rocky fine sandy loam and areas of moderately eroded and severely eroded soils.

Runoff is medium, and hazard of erosion is moderate. The available water holding capacity is 4 to 7 inches. The effective rooting depth of this soil is moderately deep to sandstone.

Most areas of this soil have been cleared and are used for dryland pasture or grain hay. It is well suited to Christmas tree production. Capability unit IVe-1 (4); range site, Fine Loamy.

Felton silt loam, 30 to 50 percent slopes (FoF).—This soil has an average slope of 40 percent.

Included with this soil in mapping are a few areas of Madonna loam and areas that have been subject to moderate sheet erosion.

This soil is used mainly for the production of timber. A few areas have been cleared and used for range. This soil is moderately productive. Site index averages about 130 (*3*). Seedling mortality is moderate, and windthrow hazard is slight. Because of steep slopes, runoff is rapid and the hazard of erosion is high after areas of this soil have been logged. Capability unit VIe-1 (4); range site, Fine Loamy.

Garretson Series

The Garretson series consists of well-drained loams that are underlain by alluvium from material derived from sedimentary rock. These soils lie on stream benches and fans along drainageways and have slopes of 0 to 5 percent. The vegetation, where these soils are not cultivated, is annual grasses and forbs, and there are a few scattered oak trees. Elevation ranges from 200 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is about 250 to 275 days. Garretson soils are associated with the Esparto, Yolo, and Zamora soils.

In a representative profile, the surface layer is a grayish-brown, neutral loam about 19 inches thick. The substratum is a brown, neutral very fine sandy loam that is underlain at a depth of 40 inches by stratified sand and gravel. In some places the surface layer and substratum are gravelly loam to a depth of 60 inches or more.

Garretson soils are used for irrigated grapes, row crops, orchards, dryland grain hay, and pasture.

Garretson loam, gravel substratum, 0 to 2 percent slopes (GoA).—This soil is on stream benches along the larger drainageways.

Representative profile (in walnut grove, 0.6 mile south of Coyote, 50 feet north off farm road, and 0.2 mile east, off U.S. Highway 101):

Ap—0 to 6 inches, grayish-brown (10YR 5/2) loam containing about 3 to 5 percent (by volume) gravel, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, nonsticky and nonplastic; neutral (pH 7.0); clear, smooth boundary. (4 to 10 inches thick.)

A1—6 to 19 inches, grayish-brown (10YR 5/2) loam containing about 2 to 3 percent medium and fine gravel (by volume), very dark grayish brown (10YR 3/2) moist; massive; hard, friable, nonsticky and nonplastic; many very fine tubular pores and few medium tubular pores; neutral (pH 7.0); clear, smooth boundary. (12 to 18 inches thick.)

C1—19 to 40 inches, brown (10YR 5/3) very fine sandy loam, dark brown (10YR 4/3) moist; massive; hard, friable, nonsticky and nonplastic; neutral (pH 7.0); clear, smooth boundary. (20 to 32 inches thick.)

IIC2—40 to 60 inches, stratified sands and gravels.

The A horizon is brown or grayish brown. Texture typically is loam but in some places is clay loam. Reaction in the A and C horizons is slightly acid or neutral to moderately alkaline. The C1 horizon is brown, pale brown, or yellowish brown. Texture is dominantly very fine sandy loam or loam but in places is gravelly loam, loam, or gravelly clay loam. Clay content of the C1 horizon averages between 18 and 25 percent. Depth to stratified sand and gravel is 36 to 60 inches. The C1 horizon in places is calcareous below 36 inches.

Included with this soil in mapping are some areas of Cortina very gravelly loam and a few areas of soils that have a sand and gravel substratum within 20 inches of the surface.

This soil has about 7.5 to 11 inches of available water holding capacity, the amount depending on depth to sand and gravel. Permeability is moderate in the horizons above the very rapidly permeable gravel. Runoff is slow, and the hazard of erosion is none to slight. Fertility is moderate. Effective rooting depth is very deep.

This soil is used for irrigated apricots, grapes, prunes, row crops, walnuts, and dryland hay and pasture. Capability unit I-1 (14) and IIIc-1 (15).

Garretson gravelly loam, 0 to 5 percent slopes (GbB).—This soil has a profile that is similar to that of Garretson loam, gravel substratum, 0 to 2 percent slopes, but it has more slope in places and the texture is gravelly loam or gravelly clay loam. This soil is 15 to 30 percent gravel to a depth of 60 inches or more.

Included with this soil in mapping are some areas of soils that have slopes of up to 9 percent, and a soil that has a dark grayish-brown, granular surface layer formed on basic igneous rock alluvium.

The available water holding capacity is 7 to 8 inches. Runoff is very slow to slow, and the hazard of erosion is none to slight.

This soil is used for irrigated apricots, prunes, vineyards, row crops, walnuts, and dryland hay or pasture. There is enough gravel present in the surface layer to interfere slightly with tillage. Capability unit IIe-1 (14) and IIIe-1 (15).

Gaviota Series

The Gaviota series consists of well-drained and somewhat excessively drained loams that are underlain by hard sandstone and shale bedrock at a depth of 6 to 20 inches. These soils are on the uplands and have slopes of 5 to 75 percent. The vegetation is annual grasses and forbs, oak trees, and brush. Elevation ranges from 500 to 4,000 feet. Average annual rainfall is 15 to 30 inches, and average annual temperature is about 58° to 60° F. The growing season is about 200 to 250 days. Gaviota soils are associated with the Los Gatos and Vallecitos soils.

In a representative profile, the surface layer is pale-brown and light yellowish-brown, slightly acid loam and gravelly loam that is about 19 inches thick and is underlain by hard sandstone. There are rock outcrops in some areas, and other areas are moderately eroded or severely eroded.

Gaviota soils are used for dryland hay, pasture, and range. They are also used for wildlife, recreation, and watershed.

Gaviota loam, 30 to 75 percent slopes (GcG).—This steep soil is on the uplands and has slopes that average about 60 percent.

Representative profile (on south-facing hillside above Mt. Hamilton Road about 3 miles above Kincaid Road intersection at road stake number B-8.70; NW¼NW¼ sec. 9, T. 9 S. R. 3 E.):

A11—0 to 5 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 3/3) moist; moderate, medium and fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial pores, common very fine tubular pores, and few medium tubular pores; slightly acid (pH 6.5); clear wavy boundary. (4 to 6 inches thick.)

A12—5 to 19 inches, light yellowish-brown (10YR 6/4) gravelly loam, dark yellowish brown (10YR 3/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; many very fine tubular pores and few medium tubular pores; slightly acid (pH 6.5); clear, wavy boundary. (6 to 14 inches thick.)

R—19 inches, yellowish-brown, hard, fractured sandstone bedrock.

The A horizon is pale brown, light brownish gray, grayish brown, brown, or light yellowish brown. Reaction is slightly acid to neutral and changes very little with increasing depth. Rock fragments in the A12 horizon consist mostly of coarse gravel, but some fine to medium gravel and a few stones are present in places. Depth to bedrock ranges from 10 to 20 inches. There is little evidence of sheet erosion, but there are occasional shallow gullies.

Included with this soil in mapping are some areas of Vallecitos rocky loam and a few areas of Rock land.

This somewhat excessively drained soil has low fertility. The available water holding capacity is 2 to 3 inches. Permeability is moderate. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. Effective rooting depth is shallow.

This soil is used for range, wildlife, watershed, and recreation. Capability unit VIIe-8(15); range site, Shallow Loamy.

Gaviota loam, 5 to 15 percent slopes, eroded (GcD2).—This soil has a profile that is similar to that of Gaviota loam, 30 to 75 percent slopes, but it is less sloping. Erosion has removed up to 4 inches of the surface layer. The depth to standstone is 6 to 16 inches.

Included with this soil in mapping are small areas of Hillgate silt loam and Pleasanton loam along drainageways, areas of Vallecitos rocky loam along ridge crests, and places where the soils have slopes of up to 20 percent.

This soil is well drained. Available water holding capacity is 1 to 2.5 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for pasture and range. Capability unit VIe-8(15); range site, Shallow Loamy.

Gaviota loam, 15 to 30 percent slopes (GcE).—This soil has a profile that is similar to that of Gaviota loam, 30 to 75 percent slopes.

Included with this soil in mapping are areas of Vallecitos rocky loam and Rock land.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is used for range. Capability unit VIe-8(15); range site, Shallow Loamy.

Gaviota gravelly loam, 30 to 75 percent slopes, eroded (GhG2).—This soil is on uplands and has an average slope of 45 percent. The surface layer is gravelly loam; it is about 20 percent (by volume) medium and fine gravel. Because of sheet erosion, depth to sandstone is 7 to 16 inches.

Included in mapping with this soil are areas of Vallecitos rocky loam that are severely eroded and Rock land.

This soil is somewhat excessively drained. The available water holding capacity is 1 to 2 inches. Natural fertility is very low.

This soil is used for limited range, recreation, and watershed. The brush cover limits the amount of available forage. Many areas have been burned, and they now support scattered brush and a scanty grass cover. Capability unit VIIe–8(15); range site, Shallow Gravelly Loam.

Gaviota gravelly loam, 30 to 75 percent slopes, severely eroded (GhG3).—This soil is on uplands. It has a profile that is similar to that of Gaviota loam, 30 to 75 percent slopes, but erosion has removed 75 percent of the surface layer and exposed the gravelly loam subsoil. Depth to bedrock is 6 to 10 inches.

Included with this soil in mapping are some areas of Rock land and of Vallecitos rocky loam, and areas where slopes exceed 75 percent.

This soil is somewhat excessively drained. The available water holding capacity is about 1 inch. Natural fertility is very low.

This brush-covered soil is used for range, wildlife, recreation, and watershed. Capability unit VIIe–8(15); range site, Shallow Gravelly Loam.

Gaviota rocky loam, 5 to 30 percent slopes, eroded (GkE2).—This soil is on uplands and has slopes that average about 25 percent. Texture is loam or shaly loam. Rock outcrops cover 2 to 10 percent of the surface. Because of sheet erosion, depth to sandstone is 10 to 17 inches.

Included with this soil in mapping are some areas of Vallecitos loam, and small areas that are severely eroded. In the San Antonio and Isabel Valleys, sloping areas of this soil are intermingled with fingerlike fans on which the Esparto soils are included.

This soil is well drained. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for range. Capability unit VIe–7(15); range site, Shallow Loamy.

Gaviota-Los Gatos complex, 30 to 50 percent slopes (GmF).—This complex consists of about 50 percent Gaviota loam, 35 percent Los Gatos gravelly loam, and 15 percent included soils. These soils are on uplands having an annual grass-woodland cover. Gaviota soils occupy the ridges and south slopes and Los Gatos soils occupy areas on the north slopes.

The Gaviota soils have a profile similar to that of Gaviota loam, 30 to 75 percent slopes. The available water holding capacity is 2 to 3 inches. Permeability is moderate. Effective rooting depth is 10 to 19 inches. Natural fertility is low.

The Los Gatos soils have a profile similar to that of Los Gatos gravelly loam, 50 to 75 percent slopes. The available water holding capacity is 4 to 7 inches. Permeability is moderately slow. Effective rooting depth is 25 to 50 inches. Natural fertility is moderate.

Included with these soils in mapping are some areas of Los Osos clay loam and Vallecitos rocky loam.

Runoff on these soils is rapid, and the hazard of erosion is high.

These soils are used for range. This complex is in capability unit VIIe–8 (15). Gaviota soil: range site, Shallow Loamy. Los Gatos soil: range site, Loamy.

Gilroy Series

The Gilroy series consists of well-drained clay loams that are underlain by basic igneous bedrock at a depth of 18 to 36 inches. These soils are on uplands and have slopes of 5 to 75 percent. The vegetation, where these soils are not cultivated, is annual grasses and forbs, oak trees, and brush. Elevation ranges from 500 to 2,000 feet. Average annual rainfall is about 20 to 25 inches, and average annual temperature is about 58° to 60° F. The growing season is about 200 to 250 days. Gilroy soils are associated with the Los Gatos, Maymen, and Henneke soils.

In a representative profile, the surface layer is a brown, medium acid clay loam about 8 inches thick. The subsoil is reddish-brown, medium acid clay loam that is underlain at 21 inches by brown, weathered basic igneous rock. In a few places these soils are eroded.

Gilroy soils are used for dryland vineyards, hayland, pasture, and range.

Gilroy clay loam, 30 to 50 percent slopes (GoF).—This soil is on well-rounded ridges and steep side slopes in the uplands.

Representative profile (0.4 mile east of Castro Valley Ranch gate on hillside northeast of Castro Valley Road; NE¼SW¼ sec. 18, T. 11 S., R. 4 E.):

A1—0 to 8 inches, brown (7.5YR 5/4) clay loam containing about 5 percent gravel (by volume), dark-brown (7.5 YR 3/2) moist; moderate, medium and fine, granular structure; hard, very friable, sticky and plastic; common, very fine roots; many very fine interstitial pores and common very fine tubular pores; medium acid (pH 6.0); clear, wavy boundary. (8 to 10 inches thick.)

B2t—8 to 21 inches, reddish-brown (5YR 4/3) clay loam containing about 5 percent (by volume) gravel, dark reddish brown (5YR 3/2) moist; moderate, medium, subangular blocky structure; hard, very friable, sticky and plastic; few very fine roots; many very fine interstitial pores and few fine and medium tubular pores; common thin clay films on ped surfaces and in pores; medium acid (pH 6.0); abrupt, irregular boundary. (12 to 26 inches thick.)

R—21 inches, brown, metamorphosed basic igneous rock (greenstone) with moderately thick clay films and black manganese stains on rock surfaces.

The A horizon typically is brown, but in some places it is dark brown, dark reddish brown, or reddish brown. Texture is clay loam that commonly contains 5 to 8 percent (by volume) medium and fine gravel. The B horizon is generally reddish brown, but in some places it is brown or dark brown. Texture is clay loam or gravelly clay loam. In a few places the B horizon tongues into fracture planes of the bedrock. Soft to hard greenstone is at a depth of 20 to 36 inches.

Included with this soil in mapping are a few areas of Los Gatos gravelly loam and small areas of clay.

The available water holding capacity of this soil is 4 to 7.5 inches. Runoff is rapid, and the hazard of erosion is high. Permeability in the subsoil is moderately slow. This soil is moderately fertile. Effective rooting depth is moderately deep.

This soil is used for range. Capability unit VIe–1 (15); range site, Loamy.

Gilroy clay loam, 5 to 30 percent slopes (GoD).—This soil is on uplands that have well-rounded ridges and footslopes. The average slope is about 20 percent.

Included with this soil in mapping are Los Gatos gravelly loam and areas of rock outcrops.

Runoff on this soil is slow to rapid, and the hazard of erosion is slight to high.

This soil is used for dryland pasture and range. Capability unit IVe–1 (15); range site, Loamy.

Gilroy clay loam, 15 to 30 percent slopes, eroded (GoE2).—This soil has a profile that is similar to that of Gilroy clay loam, 30 to 50 percent slopes, but is less sloping. Sheet erosion has removed an average of 2 to 3 inches of the surface layer. Depth to basic igneous bedrock is 18 to 33 inches.

Included with this soil in mapping are areas that have been subject to severe rill and sheet erosion and small areas of shallow soils. Tillage has mixed the soft, weathered bedrock with the surface layer and subsoil in a few areas.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

Most of the acreage of this soil in the past was planted to grapes or was used for dryland grain hay, but now most of it is used for pasture or range. Capability unit IVe-1 (15); range site, Loamy.

Gilroy clay loam, 50 to 75 percent slopes (GoG).—This soil has a profile that is similar to that of Gilroy clay loam, 30 to 50 percent slopes, but it is steeper. The surface layer is dark brown or dark reddish brown on the north slopes.

Included with this soil in mapping are a few areas of Los Gatos gravelly loam and Maymen rocky fine sandy loam, areas of rock outcrops, and some places where depth to bedrock is 40 to 50 inches.

Runoff on this soil is very rapid, and the hazard of erosion is very high.

This soil is used for range, wildlife, recreation, and watershed. Capability unit VIIe-1 (15); range site, Loamy.

Henneke Series

The Henneke series consists of somewhat excessively drained gravelly clay loams that are underlain by serpentine bedrock at a depth of 11 to 18 inches. These soils are on uplands and have slopes of 30 to 75 percent. The vegetation is brush and some Digger pines. Elevation ranges from 1,600 to 2,500 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is about 58° to 60° F. The growing season is about 200 to 250 days. Henneke soils are associated with the Gaviota, Los Gatos, and Vallecitos soils.

In a representative profile, the surface layer is reddish-brown, neutral gravelly clay loam about 1 inch thick. The subsoil is dark reddish brown, neutral very gravelly clay that is underlain at a depth of 15 inches by serpentine bedrock. Rock outcrops are on 2 to 10 percent of the surface.

Henneke soils are used mainly for watershed, recreation, and wildlife.

Henneke rocky clay loam, 30 to 75 percent slopes, severely eroded (HeG3).—This soil lies on uplands and has slopes that average 60 percent.

Representative profile (from intersection of Mines and Blackbird Valley roads, up hillside about 200 yards from "S" turn on Mines road, in northwest corner of SE¼ sec. 11, T. 6 S., R. 4 E.):

A1—0 to 1 inch, reddish-brown (5YR 4/3) gravelly clay loam, dark reddish brown (5YR 2/2) moist; strong, fine, granular structure; slightly hard, very friable, sticky and plastic; few very fine, fine, medium, and coarse roots; many very fine interstitial pores; neutral (pH 7.0); clear, smooth boundary. (1 to 4 inches thick.)

B2t—1 to 15 inches, dark reddish-brown (5YR 3/3) very gravelly clay containing 55 percent (by volume) medium and fine gravel, dark reddish brown (5YR 2/2) moist; strong, fine and medium, subangular blocky structure; hard, friable, sticky and plastic; few, very fine, medium, and coarse roots; many very fine interstitial and tubular pores and few medium and coarse tubular pores; many moderately thick clay films on ped surfaces and in pores; neutral (pH 7.0); clear, smooth boundary.

R—15 inches, serpentine rock.

The A horizon is strong brown or reddish brown. Reaction is slightly acid to neutral. Texture is clay loam, gravelly clay loam, or loam. The B horizon is slightly acid to neutral. Depth to bedrock ranges from 11 to 18 inches. This soil is severely eroded. Rock outcrops cover about 2 to 10 percent of the surface.

Included with this soil in mapping are small areas of Gaviota loam, Vallecitos rocky loam, and Rock land. Also included are areas that have less than 30 percent gravel throughout the profile.

The available water holding capacity of this soil is 1 to 2 inches. Permeability is slow. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. Natural fertility is low. Effective rooting depth is shallow.

This soil is used for range, wildlife, recreation, and watershed. Capability unit VIIe-9 (15); range site, Serpentine.

Hillgate Series

The Hillgate series consists of well-drained silt loams that have developed in alluvial materials from mixed sources. These soils are on terraces and have slopes of 2 to 50 percent. The vegetation, where these soils are not cultivated, is annual grasses, forbs, and scattered oak trees. Elevation ranges from 200 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is about 58° to 60° F. The growing season is about 260 to 275 days. Hillgate soils are associated with the Azule, Pleasanton, and San Ysidro soils.

In a representative profile, the surface layer is pale-brown and brown, medium acid silt loam about 10 inches thick. The subsoil is strong-brown and brownish-yellow, medium acid clay and clay loam that are underlain at a depth of 40 inches by brownish-yellow, medium acid gravelly clay loam.

Hillgate soils are used for irrigated apricots, vineyards, prunes, and dryland hay, pasture, and range.

Hillgate silt loam, 9 to 15 percent slopes, eroded (HfD2).—This soil is on terraces.

Representative profile (from intersection of Church and New Avenues, 200 yards east and 200 yards south in field; SW¼NW¼ sec. 8, T. 10 S., R. 4 E.):

Ap—0 to 5 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; massive; hard, friable, nonsticky and nonplastic; many fine and very fine roots; many very fine interstitial pores and few very fine and fine tubular pores; medium acid (pH 5.8); abrupt, smooth boundary. (4 to 7 inches thick.)

A1—5 to 10 inches, brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; massive; very hard, friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores, many very fine tubular pores, and few medium tubular pores; medium acid (pH 5.8); abrupt, smooth boundary. (4 to 19 inches thick.)

B2t—10 to 26 inches, strong-brown (7.5YR 5/6) clay, dark brown (7.5YR 4/4) moist; moderate, coarse, prismatic structure parting to strong, coarse and medium, angular blocky structure; extremely hard, very firm, sticky and very plastic; few very fine roots; many very fine interstitial pores, common very fine tubular pores, and few fine tubular pores; many, moderately thick, reddish-brown (5YR 5/4) moist clay films on ped surfaces and in pores; medium acid (pH 5.8); gradual, wavy boundary. (14 to 24 inches thick.)

B3t—26 to 40 inches, brownish-yellow (10YR 6/6) clay loam, yellowish brown (10YR 5/4) moist; moderate, coarse, angular blocky structure; very hard, firm, sticky and very plastic; many very fine interstitial pores, common very fine tubular pores, and a few fine tubular pores; common, thin, reddish-yellow (7.5YR 6/6), strong-brown (7.5YR 5/6), moist clay films on ped surfaces and in pores; medium acid (pH 5.8); clear, smooth boundary. (12 to 20 inches thick.)

IIC—40 to 60 inches, brownish-yellow (10YR 6/6) gravelly clay loam, yellowish brown (10YR 5/4) moist; weak, medium, subangular blocky structure; hard, friable, sticky and plastic; many very fine interstitial pores and a few very fine and fine tubular pores; few, thin, reddish-yellow (7.5YR 6/6), strong-brown (7.5YR 5/6) moist clay films on ped surfaces and in pores; medium acid (pH 5.8).

The A horizon ranges from pale brown to brown, or grayish brown. Reaction is neutral to medium acid. Texture is silt loam or fine sandy loam. The B horizon is brown, strong brown, or brownish yellow. Texture is clay or gravelly clay and ranges to clay loam in the lower part of the B horizon. Depth to the clay B2t horizon averages 10 inches but it ranges from 8 to 20 inches.

Included with this soil in mapping are 40 acres of soils along Little Arthur Creek that are underlain by sandstone bedrock at a depth of 20 to 40 inches. Also included are small areas of Pleasanton gravelly loam and San Ysidro loam. Other included areas have a yellowish-red and reddish-brown B horizon or a calcareous substratum.

The available water holding capacity of this soil is 4 to 7 inches. Permeability is very slow. Runoff is medium, and the hazard of erosion is moderate. Natural fertility is low. Effective rooting depth is very deep.

This soil is used for dryland hay, pasture, and range. Capability unit VIe-3 (15); range site, Claypan.

Hillgate silt loam, 2 to 9 percent slopes (HfC).—This soil is on terraces. It has a profile that is similar to that of Hillgate silt loam, 9 to 15 percent slopes, eroded, but the surface layer is 20 to 26 inches thick. Erosion is none to slight.

Included with this soil in mapping are small areas of Pleasanton gravelly loam and San Ysidro loam.

Natural fertility of this soil is moderate. Effective rooting depth is very deep.

This soil is used for irrigated prunes, apricots, and grapes, and for dryland hay and pasture. Capability unit IIIe-3 (14).

Hillgate silt loam, 15 to 30 percent slopes, eroded (HfE2).—This soil has a profile that is similar to that of Hillgate silt loam, 9 to 15 percent slopes, eroded, but has a surface layer 10 to 20 inches thick.

Included with this soil in mapping are small areas of Azule clay loam and areas that have been subject to severe sheet and gully erosion. Also included in the San Antonio Valley are areas of a soil that is moderately alkaline and is calcareous in the substratum.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is used for range. Capability unit VIe-3 (15); range site, Claypan.

Hillgate silt loam, 30 to 50 percent slopes, eroded (HfF2).—This soil has a profile that is similar to that of Hillgate silt loam, 9 to 15 percent slopes, eroded, but it is more sloping and depth to the clay subsoil is 10 to 20 inches. Texture of the subsoil ranges from heavy clay loam to clay, and in some places it is gravelly.

Included with this soil in mapping are areas of Azule clay loam and small areas that have been subject to severe sheet and gully erosion.

The available water holding capacity is 2 to 4 inches for the 10- to 20-inch rooting depth. Runoff is rapid, and the hazard of erosion is high.

This soil is used for range. Capability unit VIIe-1 (15); range site, Claypan.

Inks Series

The Inks series consists of somewhat excessively drained gravelly clay loams that are underlain by metamorphosed basic igneous bedrock at a depth of 11 to 19 inches. They are on uplands and have slopes of 30 to 75 percent. The vegetation mainly is brush, but there are a few open areas of annual grasses and forbs. Elevation ranges from 200 to 2,000 feet. Average annual rainfall is 20 to 25 inches, and average annual temperature is about 58° to 60° F. The growing season is about 200 to 250 days. Inks soils are associated with the Los Gatos and Montara soils.

In a representative profile, the surface layer is brown, slightly acid gravelly clay loam about 1 inch thick. In some places it is stony clay loam. The subsoil is dark reddish-brown, slightly acid gravelly clay loam that is underlain at a depth of 15 inches by hard, shattered metamorphosed basalt.

Inks soils are used for range, wildlife, recreation, and watershed.

Inks rocky clay loam, 50 to 75 percent slopes, eroded (InG2).—This soil is on uplands.

Representative profile (near Morgan Hill, about 1 mile north of Pigeon Point on road along ridge):

A1—0 to 1 inch, brown (7.5YR 5/4) gravelly clay loam, 20 percent (by volume) gravel, ¼ to 1 inch in diameter, dark brown (7.5YR 3/2) moist; weak, medium, subangular blocky structure parting to moderate, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial and tubular pores; slightly acid (pH 6.5); abrupt, smooth boundary. (1 to 4 inches thick.)

B2t—1 to 15 inches, dark reddish-brown (5YR 3/3) gravelly clay loam, dark reddish brown (5YR 3/2) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; many very fine interstitial and tubular pores; continuous thin clay films on ped surfaces and in pores; slightly acid (pH 6.5); clear, irregular boundary. (11 to 15 inches thick.)

R—15 inches, hard metamorphosed basalt.

The A horizon is brown or dark brown. Reaction is slightly acid to neutral and changes little with depth. Texture is gravelly loam or gravelly clay loam. Percentage of gravel by volume generally is between 20 and 40 percent. The B horizon is typically dark reddish brown but in places is brown or dark brown. Texture is gravelly clay loam that contains 30 to 40 percent rock fragments 1 to 6 inches in diameter. Depth to hard bedrock ranges from 11 to 19 inches. About 2 to 10 percent of the surface is covered by rock outcrops, and variable amounts of stones are on the surface.

Included with this soil in mapping are some areas of Montara rocky clay loam and Henneke rocky clay loam, small areas of Rock land, and areas of soils that have steep and moderately steep slopes.

The available water holding capacity of this soil is 1 to 2 inches. Permeability in the subsoil is moderately slow. Runoff is very rapid, and the hazard of erosion is very high.

Fertility is low. Effective rooting depth is shallow to bedrock.

This soil is used for range, wildlife, and watershed. Capability unit VIIe–7 (15); range site, Shallow Loamy.

Inks stony clay loam, 30 to 75 percent slopes, severely eroded (IsG3).—This soil is on uplands and has slopes that average about 60 percent. Stones and rock outcrops cover about 3 to 10 percent of the surface. The surface layer has been removed in most places by erosion. Depth to bedrock is 11 to 15 inches.

Included with this soil in mapping are small areas of Henneke rocky clay loam and areas of soils that have slopes of 15 to 30 percent.

This soil is used for range, wildlife, recreation, and watershed. Capability unit VIIe–7 (15); range site, Shallow Gravelly Loam.

Keefers Series

The Keefers series consists of well-drained clay loams that are underlain by alluvium from basic igneous rock. These soils lie on old fans and have slopes of 0 to 9 percent. The vegetation, where these soils are not cultivated, is annual grasses, forbs, and scattered oak trees. Elevation ranges from 200 to 800 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is 260 to 275 days. Keefers soils are associated with the Cropley and Los Robles soils.

In a representative profile, the surface layer is brown, slightly acid clay loam about 12 inches thick. The subsoil is reddish-brown and brown, slightly acid to mildly alkaline gravelly clay loam, very gravelly clay loam, and gravelly clay to a depth of 60 inches or more.

Keefers soils are used for irrigated row crops, orchards, vineyards, pasture, and dryland hay.

Keefers clay loam, 2 to 9 percent slopes, eroded (KeC2).—This soil is on smooth, old fans and has slopes that average 5 percent.

Representative profile (off California Avenue, about 20 feet north and 100 yards east of its intersection with Cooledge Avenue):

Ap—0 to 5 inches, brown (7.5YR 5/4) clay loam containing 10 percent (by volume) medium and fine gravel, dark reddish brown (5YR 3/3) moist; moderate, medium and fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine and medium roots; many fine interstitial and tubular pores; slightly acid (pH 6.5); clear, smooth boundary. (5 to 7 inches thick.)

A1—5 to 12 inches, brown (7.5YR 5/4) clay loam containing 10 percent (by volume) medium and fine gravel, dark reddish brown (5YR 3/4) moist; massive; hard, very friable, slightly sticky and slightly plastic; few fine roots; many very fine interstitial pores and few medium tubular pores; slightly acid (pH 6.5); clear, wavy boundary. (7 to 9 inches thick.)

B1t—12 to 23 inches, reddish-brown (5YR 5/3) gravelly clay loam containing 20 percent (by volume) medium and fine gravel, dark reddish brown (5YR 3/4) moist; moderate, medium, subangular blocky structure; hard, very friable, sticky and plastic; few fine and medium roots; many very fine interstitial and tubular pores; few thin clay films on ped surfaces and in pores; slightly acid (pH 6.5); clear, wavy boundary. (10 to 12 inches thick.)

B2t—23 to 38 inches, reddish-brown (5YR 4/3) very gravelly heavy clay loam containing about 60 percent (by volume) medium and fine gravel, dark reddish brown (5YR 3/4) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; many very fine interstitial and tubular pores; many moderately thick clay films on ped surfaces and in pores; neutral (pH 7.0); clear, irregular boundary. (14 to 18 inches thick.)

IIB3t—38 to 60 inches, brown (7.5YR 5/4) gravelly clay containing about 20 percent (by volume) fine gravel, dark brown (7.5YR 4/4) moist; massive; very hard, firm, sticky and plastic; many very fine interstitial pores; common thin clay films lining pores and coating the fine gravel; some manganese coatings on gravel; mildly alkaline (pH 7.5).

The A horizon is typically brown but in places is dark brown or reddish brown. Texture is clay loam, and this horizon contains up to 15 percent (by volume) medium and fine gravel. The B2t horizon is very gravelly heavy clay loam or very gravelly clay. The gravel is generally fine but ranges to medium or coarse and averages a little more than 50 percent by volume. In most areas this soil overlies unrelated gravelly clay or clay in the IIB3t or IIC horizons at a depth of 36 to 60 inches.

Included with this soil in mapping are small seep and marsh areas and a few areas of Cropley clay.

The available water holding capacity of this soil is 6.5 to 8 inches. Permeability in the subsoil is slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Natural fertility is moderate. Effective rooting depth is very deep.

This soil is used for irrigated row crops, prunes, grapes, and walnuts. A few areas are used for dryland pasture or grain hay. Capability unit IIIe–3 (14).

Keefers clay loam, 0 to 2 percent slopes (KeA).—This soil lies on smooth, old fans. Hazard of erosion is slight.

Included with this soil in mapping are small areas of Cropley clay and San Ysidro loam, small seep and marsh areas, and areas of gravelly clay loam and gravelly loam.

Runoff is very slow, and water tends to pond during the rainy season. The hazard of erosion is none to slight.

This soil is used for irrigated row crops, prunes, walnuts, and pasture. A few areas are used for dryland pasture or grain hay. Capability unit IIIs–3 (14).

Landslides

Landslides (LaF) consists of areas of soils that have moved downslope and have an uneven or broken surface as a result of slippage. Soil material is generally fine textured and ranges from clay loam to clay. The soil mantle and water regime have been disturbed so much that the soil characteristics are unpredictable. Landslides occur on slopes of 30 to 50 percent and are associated mainly with Altamont, Azule, Climara, and Diablo soils.

This well-drained land type is moderately fertile. Available water holding capacity is 5 to 8 inches. Runoff is rapid, and the hazard of erosion is high.

This land type is used for range. Capability unit VIIe–5 (15); range site, Clayey.

Los Gatos Series

The Los Gatos series consists of well-drained gravelly loams that are underlain by metamorphosed shale at a depth of 25 to 50 inches. These soils have slopes of 15 to 75 percent and are on uplands. Vegetation consists mainly of oaks that have an understory of brush, grass, and forbs. Elevation ranges from 500 to 4,000 feet. Average annual rainfall is about 25 to 40 inches, and average temperature is about 55° to 56° F. The growing season is 200 to 250 days. Los Gatos soils are associated with the Gaviota, Gilroy, and Maymen soils.

In a representative profile, the surface layer is brown, slightly acid gravelly loam about 10 inches thick. The subsoil is brown, reddish-brown, and yellowish-brown, medium acid gravelly clay loam underlain at a depth of 35 inches by moderately hard, shattered metamorphosed shale.

Los Gatos soils are used for dryland vineyards, hay, pasture, range, wildlife, recreation, and watershed.

Los Gatos gravelly loam, 50 to 75 percent slopes (LfG).—This soil is on uplands.

Representative profile (from Uvas Dam, 0.7 mile north on Uvas Road, in road cut 295 feet west on dirt road; SW¼SE¼ sec. 12, T. 10 S., R. 2 E.):

A11—0 to 3 inches, brown (7.5YR 5/4) gravelly loam containing about 15 percent (by volume) medium and fine angular gravel, dark brown (7.5YR 3/2) moist; strong, medium and fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine interstitial pores; slightly acid (ph 6.5); clear, smooth boundary. (0 to 6 inches thick.)

A12—3 to 10 inches, brown (7.5YR 5/4) gravelly loam containing about 15 percent (by volume) medium and fine angular gravel, dark brown (7.5YR 3/3) moist; moderate, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots and few coarse roots; many very fine interstitial pores and few medium and coarse tubular pores; slightly acid (pH 6.1); clear, smooth boundary. (6 to 10 inches thick.)

B1t—10 to 16 inches, brown (7.5YR 5/4) gravelly clay loam containing about 16 percent medium and fine gravel, dark brown (7.5YR 3/2) moist; moderate, medium, subangular blocky structure; slightly hard, friable, sticky and plastic; common fine and medium roots, and few coarse roots; many very fine interstitial and tubular pores and few medium and coarse tubular pores; common thin clay films on ped surfaces and in pores; medium acid (pH 6.0); clear, wavy boundary. (5 to 12 inches thick.)

B2t—16 to 27 inches, reddish-brown (5YR 5/4) gravelly clay loam containing about 11 percent medium and fine gravel, dark reddish brown (5YR 3/4) moist; medium, moderate, subangular blocky structure; hard, friable, sticky and plastic; few fine, medium, and coarse roots; many very fine interstitial and tubular pores and few medium and coarse tubular pores; continuous thin clay films on ped surfaces and in pores; medium acid (pH 6.0); diffuse, smooth boundary. (8 to 12 inches thick.)

B3t—27 to 35 inches, yellowish-brown (10YR 5/6) gravelly clay loam containing about 11 percent medium and fine gravel, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, sticky and plastic; few fine, medium and coarse pores; many thin clay bridges between sand grains and many thin clay films in pores; medium acid (pH 6.0); abrupt, irregular boundary. (6 to 10 inches thick.)

R—35 inches, shattered, hard metamorphosed shale rock with few clay films along cracks; becomes massive with increasing depth.

The A horizon is brown or dark brown. Reaction is slightly acid to neutral. Texture is dominantly loam but in places is clay loam, and this horizon contains 15 to 20 percent (by volume) gravel. The B horizon is brown, strong brown, reddish brown, or yellowish brown. The lower part of the B horizon is heavy gravelly loam or gravelly clay loam. Depth to hard shale rock is 25 to 50 inches.

Included with this soil in mapping are areas that have been subject to moderate sheet erosion; Maymen rocky fine sandy loam, generally on south slopes and along ridge crests; and Gilroy clay loam, located mainly along fault lines.

This soil is moderately fertile. Available water holding capacity is about 4 to 8 inches, depending on depth to shale. Permeability of the subsoil is moderately slow. Runoff is very rapid, and the hazard of erosion is very high. Effective rooting depth is moderately deep to deep.

This soil is used mostly for wildlife, recreation, and watershed. A few areas are used for range. Capability unit VIIe-1 (15); range site, Loamy.

Los Gatos gravelly loam, 15 to 30 percent slopes, eroded (LfE2).—This soil is on the uplands, mainly on the crests of well-rounded ridges and footslopes. The typical slope is about 20 percent. About 2 to 8 inches of the topsoil has been removed by sheet and rill erosion. In a few small areas the subsoil has been exposed by erosion.

Included with this soil in mapping are a few areas of Maymen rocky fine sandy loam and areas that are severely eroded.

This soil has an available water holding capacity of about 4 to 7 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high. The effective rooting depth is moderately deep.

Most of this soil is used for dryland grain hay, grapes, pasture, and range. Capability unit IVe-1 (15); range site, Loamy.

Los Gatos gravelly loam, 30 to 50 percent slopes (LfF).—This soil is on uplands and has slopes that average about 35 percent. It has a profile that is similar to that of Los Gatos gravelly loam, 50 to 75 percent slopes except the surface layer generally is dark brown on the north slopes.

Included with this soil in mapping are some areas of Maymen rocky fine sandy loam and Gilroy clay loam, and areas of a calcareous soil.

Runoff is rapid, and the hazard of erosion is high.

This soil is used for range. Capability unit VIe-1 (15); range site, Loamy.

Los Gatos-Gaviota complex, 50 to 75 percent slopes (LhG).—This complex consists of about 60 percent Los Gatos gravelly loam, 25 percent Gaviota loam, and 15 percent included soils. These soils are on uplands under a cover of grass and woodland. Los Gatos soils are on the north slopes. Gaviota soils are on the ridges and south slopes.

Included in mapping are areas of Vallecitos rocky loam, Los Osos clay loam, and Altamont clay; areas of Rock land; areas of soils that have slopes that range to 80 percent; and areas of soils that have been subject to moderate sheet erosion.

The Los Gatos soils have a profile similar to that of Los Gatos gravelly loam, 50 to 75 percent slopes. Permeability is moderately slow. Available water holding capacity is 4 to 8 inches. Effective rooting depth is 25 to 50 inches. Natural fertility is moderate.

The Gaviota soils have a profile similar to that of Gaviota loam, 30 to 75 percent slopes. Permeability is moderate. Available water holding capacity is 2 to 3 inches. Effective rooting depth is 10 to 19 inches. Natural fertility is low.

Both of these soils have very rapid runoff and a very high hazard of erosion.

These soils are used for range. This complex is in capability unit VIIe-8 (15). Los Gatos soil: range site, Loamy. Gaviota soil: range site, Shallow Loamy.

Los Osos Series

The Los Osos series consists of well-drained clay loams that are underlain by sedimentary rock at a depth of 26 to 40 inches. These soils have slopes of 15 to 75 percent and are on uplands. The vegetation, where these soils are not cultivated, is annual grasses and forbs, oak trees, and brush. Elevation ranges from 300 to 1,200 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is about 58° to 60° F. The growing season is about 200 to 250 days. Los Osos soils are associated with the Azule and Los Gatos soils.

In a representative profile, the surface layer is a dark grayish-brown, slightly acid clay loam about 10 inches thick. The subsoil is dark-brown, slightly acid clay that is underlain at a depth of 36 inches by moderately hard, fine-grained sandstone and shale.

Los Osos soils are used for dryland hay, pasture, and range.

Los Osos clay loam, 15 to 30 percent slopes (LoE).—This soil is on uplands and has slopes that average about 20 percent.

Representative profile (0.7 mile east on Highway 152 from San Felipe Road, 0.5 mile up old Pacheco Pass Road. 0.5 mile north on ridge by old corral):

A1—0 to 10 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; many very fine roots; many very fine interstitial pores, common very fine tubular pores, and few fine tubular pores; slightly acid (pH 6.1); gradual, smooth boundary. (8 to 12 inches thick.)

B21t—10 to 23 inches, dark-brown (10YR 4/3) clay, very dark grayish brown (10YR 3/2) moist; strong, medium and coarse, subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; many very fine interstitial and tubular pores; many thin clay films on ped surfaces and in pores; slightly acid (pH 6.5); clear, wavy boundary. (9 to 14 inches thick.)

B22t—23 to 36 inches, dark-brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; weak, coarse, subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; common fine tubular pores; continuous thin clay films on ped surfaces and in pores; slightly acid (pH 6.5); clear, wavy boundary. (9 to 14 inches thick.)

R—36 inches, yellowish-brown, moderately hard, fine-grained sandstone and shale.

The A horizon is grayish brown or dark grayish brown. Reaction is neutral to medium acid. Texture is typically clay loam but ranges to loam. The B horizon is brown, dark brown, or yellowish brown. Texture is heavy clay loam or clay. Reaction is slightly acid to neutral. Depth to parent bedrock ranges from 26 to 40 inches. Lime is present in seams of the bedrock in a few places.

Included with this soil in mapping are some areas of Gaviota loam and Los Gatos gravelly loam, areas of rock outcrop, and areas that are moderately eroded to severely eroded.

Available water holding capacity is 4 to 8 inches, depending on depth to bedrock. Permeability in the subsoil is slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. This soil is highly fertile. Effective rooting depth is moderately deep.

This soil is used for dryland hay, pasture, and range. Capability unit IVe-3 (15); range site, Fine Loamy.

Los Osos clay loam, 30 to 50 percent slopes (LoF).—This soil lies on uplands. The slopes are generally complex and average about 40 percent.

Included with this soil in mapping are areas of Diablo clay and areas that have been subject to moderate to severe sheet erosion.

Runoff is rapid, and the hazard of erosion is high.

This soil is used for range. Capability unit VIe-3 (15); range site, Fine Loamy.

Los Osos clay loam, 50 to 75 percent slopes (LoG).—This soil is on uplands. The slopes are generally complex and average about 55 percent. Vegetation on the northerly slopes consists of oak trees that have an understory of brush, grasses, and forbs. On the southerly slopes are mostly open stands of grasses and forbs.

Included with this soil in mapping are small areas of Altamont clay and San Benito clay loam, areas of Rock land, and areas that have been subject to moderate to severe sheet erosion.

Runoff is very rapid, and the hazard of erosion is very high.

This soil is used for range. Capability unit VIIe-1 (15); range site, Fine Loamy.

Los Robles Series

The Los Robles series consists of well-drained clay loams that are underlain by stratified basic igneous rock alluvium. These soils are on alluvial fans and have slopes of 0 to 9 percent. Vegetation, where these soils are not cultivated, is annual grasses, forbs and scattered large oak trees. Elevation ranges from 200 to 1,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is about 260 to 275 days. Los Robles soils are associated with the Cropley and Keefers soils.

In a representative profile, the surface layer is dark-brown neutral clay loam about 9 inches thick. The subsoil is dark-brown and brown, neutral clay loam and gravelly clay loam that is underlain at a depth of 58 inches by yellowish-brown, neutral gravelly fine sandy clay loam.

Los Robles soils are used for irrigated row crops, orchards, vineyards, dryland hay, and pasture.

Los Robles clay loam, 0 to 2 percent slopes (LrA).—This soil is on smooth fans.

Representative profile (about 1,000 feet north on Turlock Avenue from intersection with Fitzgerald Road, in prune orchard about 12 tree rows south from driveway and 6 tree rows east from loading area):

Ap1—0 to 5 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; massive; slightly hard, very friable, sticky and plastic; many very fine roots; many very fine interstitial pores; neutral (pH 7.0); abrupt, smooth boundary. (4 to 6 inches thick.)

Ap2—5 to 9 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; massive; slightly hard, very friable, sticky and plastic; common very fine roots; many very fine interstitial and tubular pores and few medium tubular pores; neutral (pH 7.0); clear, wavy boundary. (4 to 6 inches thick.)

B1t—9 to 14 inches, dark-brown (7.5YR 4/2) clay loam containing 8 percent (by volume) medium and the gravel, dark brown (7.5YR 3/2) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; many very fine interstitial and tubular pores and few fine and medium tubular pores; common thin clay films on ped surfaces and in pores; neutral (pH 7.0); clear, wavy boundary. (4 to 8 inches thick.)

B2t—14 to 28 inches, dark-brown (10YR 4/3) gravelly clay loam containing about 15 percent (by volume) fine gravel, dark brown (10YR 3/3) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; few fine roots; many very fine interstitial and tubular pores and few medium tubular pores; continuous thin clay films on ped surfaces and in pores; neutral (pH 7.0); clear, wavy boundary. (12 to 16 inches thick.)

B3t—28 to 58 inches, brown (10YR 5/3) gravelly clay loam containing about 20 percent (by volume) fine gravel, dark brown (10YR 4/3) moist; weak, medium, subangular blocky structure; hard, friable, sticky and plastic; common thin clay films on ped surfaces and in pores; neutral (pH 7.0); clear, wavy boundary. (20 to 30 inches thick.)

C—58 to 60 inches, yellowish-brown (10YR 5/4) gravelly fine sandy clay loam containing about 40 percent (by volume) fine gravel, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, sticky and plastic; many very fine interstitial and tubular pores; neutral (pH 7.0).

The A horizon is commonly dark brown or brown but ranges to dark grayish brown. It contains less than 1.2 percent organic matter below a depth of 5 inches. Reaction is slightly acid to neutral. The B horizon is dark-brown to brown clay loam containing 5 to 45 percent gravel, and content of gravel increases with depth. There is a slight increase in the content of clay in the B horizon. Reaction is slightly acid to mildly alkaline.

Included with this soil in mapping are some areas of Cropley clay and Keefers clay loam, small areas of gravelly loam, and some seep areas.

The available water holding capacity is about 9 to 11 inches. Runoff is very slow, and the hazard of erosion is none to slight. Permeability in the subsoil is moderately slow. Fertility is high. Effective rooting depth is very deep.

This soil is used for irrigated row crops, apricots, dryland hay, and pasture. Capability unit I-3 (14).

Los Robles clay loam, 2 to 9 percent slopes (LrC).—This soil is on small alluvial fans that extend up into narrow drainageways. The average slope is about 5 percent.

Included with this soil in mapping are small areas of Cropley clay, stringers of gravelly clay loam, and soils that developed from serpentine rock alluvium.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for irrigated prunes, row crops, grapes, apricots, walnuts, dryland hay, and pasture. Capability unit IIe-1 (14).

Madonna Series

The Madonna series consists of well-drained loams that are underlain by sedimentary bedrock at a depth of 20 to 28 inches. These soils have slopes of 15 to 75 percent and lie on uplands. The vegetation, where these soils are not cultivated, is oak trees, some brush, grasses, and forbs. Elevation ranges from 1,500 to 3,500 feet. Average annual rainfall is 35 to 50 inches, and average annual temperature is about 55° to 56° F. The growing season is about 200 to 250 days. Madonna soils are associated with the Maymen, Ben Lomond, and Los Gatos soils.

In a representative profile, the surface layer is pale-brown, medium acid loam about 7 inches thick. The subsoil is brown, medium acid loam. At a depth of 25 inches is light yellowish-brown, strongly acid sandstone.

Madonna soils are used for dryland hay, pasture, range, recreation, and watershed.

Madonna loam, 30 to 50 percent slopes (MbF).—This soil is on uplands and has slopes that average about 35 percent.

Representative profile (on west-facing slope 50 feet from intersection of old Watsonville Road, just below fence in the southeast corner; NW¼NW¼ sec. 21, T. 10 S., R. 2 E.):

A1—0 to 7 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; moderate, medium and fine, granular structure; hard, friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial and tubular pores; medium acid (pH 5.6); clear, wavy boundary. (8 to 10 inches thick.)

B2—7 to 25 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak, medium, subangular blocky structure; hard, friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial and tubular pores and few medium tubular pores; medium acid (pH 5.6); clear, wavy boundary. (12 to 18 inches thick.)

R—25 inches, light yellowish-brown (10YR 6/4), strongly acid sandstone.

The A horizon generally is pale brown, light brownish gray, or brown. In a few areas, however, it is grayish brown in the upper 4 inches. Texture is loam, light loam, or fine sandy loam. The B horizon is pale brown, brown, light yellowish brown, or very pale brown. Texture is loam, light loam, or fine sandy loam. Reaction is medium acid to strongly acid. Depth to the strongly acid hard sandstone bedrock ranges from 20 to 28 inches.

Included with this soil in mapping are small areas of Maymen rocky fine sandy loam along the ridge crests, small areas that have been subject to moderate to severe sheet erosion, and areas of rock outcrop.

The available water holding capacity of this soil is about 3 to 5 inches. Permeability is moderate. Runoff is rapid, and the hazard of erosion is high. Natural fertility is moderate. Effective rooting depth is moderately deep to bedrock.

This soil is used for range, recreation, and watershed. Capability unit VIe-8 (4); range site, Loamy.

Madonna loam, 15 to 30 percent slopes (MbE).—This soil is on uplands, mainly on top of the round, broad ridges or on footslopes.

Included with this soil in mapping are some areas that have been subject to moderate and severe sheet erosion, and areas of rock outcrop.

Runoff is medium to rapid. The hazard of erosion is moderate to high.

This soil is used for dryland grain hay, pasture, and range. Capability unit IVe-8 (4); range site, Loamy.

Madonna loam, 50 to 75 percent slopes (MbG).—This soil has very steep slopes that average about 55 percent.

Included with this soil in mapping are some areas of Los Gatos gravelly loam, Maymen rocky fine sandy loam, and Rock land.

Runoff is very rapid. The hazard of erosion is very high.

This soil has limited use for range. It is used for recreation and watershed. Capability unit VIIe-8 (4); range site, Loamy.

Maxwell Series

The Maxwell series consists of moderately well drained clays that are underlain by serpentine alluvium. These soils are on alluvial fans and have slopes of 0 to 5 percent. The vegetation, where these soils are not cultivated, is annual grasses and scattered oaks. Elevation ranges from 200 to 1,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is about 260 to 275 days. Maxwell soils are associated with the Climara and Montara soils.

In a representative profile, the surface layer is very dark gray, neutral and mildly alkaline clay about 25 inches thick. The next layer is dark-gray, moderately alkaline clay that is underlain at a depth of 46 inches by dark grayish-brown, calcareous, moderately alkaline gravelly clay loam that extends to a depth of 60 inches or more. When these soils are dry, deep cracks develop in the surface layer and in the upper part of the substratum.

Maxwell soils are used for irrigated orchards, dryland grain hay, and pasture.

Maxwell clay, 0 to 5 percent slopes (McB).—This soil is on alluvial fans.

Representative profile (in field by fence corner on south side of road, 1,400 feet west on Llagas Avenue from intersection with Orchard Avenue):

Ap—0 to 7 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; strong, medium and fine, granular structure; very hard, very firm, sticky and very plastic; many very fine roots; many very fine interstitial pores; neutral (pH 7.0); abrupt, smooth boundary. (4 to 10 inches thick.)

A1—7 to 25 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate, coarse, prismatic structure; very hard, very firm, sticky and very plastic; few very fine roots; many very fine interstitial pores; common fine and medium slickensides; mildly alkaline (pH 7.5); clear, wavy boundary. (20 to 30 inches thick.)

C1—25 to 46 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; massive; hard, firm, sticky and very plastic; many very fine interstitial and tubular pores; common fine and medium slickensides; moderately alkaline (pH 8.0); clear, smooth boundary. (12 to 24 inches thick.)

C2—46 to 60 inches, dark grayish-brown (2.5Y 4/2) gravelly clay loam, very dark grayish brown (2.5Y 3/2) moist; massive; hard, friable, sticky and plastic; many very fine interstitial and tubular pores; calcareous, moderately alkaline (pH 8.0).

The A horizon is dark gray or very dark gray. Reaction is neutral to mildly alkaline. Depth to lime ranges from 24 to 48 inches. When the soil is dry, deep cracks develop that average from ½ to 1½ inches in width in the A horizon and in the upper part of the C horizon.

Included with this soil in mapping are small areas of gravelly clay texture and a few areas of buried soils that have characteristics similar to those of the Hillgate and Pleasanton soils.

The available water holding capacity of this soil is 8 to 10 inches. Permeability is slow. Runoff is very slow to slow, and the hazard of erosion is none to slight. This soil has low natural fertility because of an unfavorable calcium-magnesium ratio. Effective rooting depth is very deep.

This soil is used for irrigated prunes, dryland grain hay, and pasture. Capability unit IVs-9 (14).

Maymen Series

The Maymen series consists of somewhat excessively drained fine sandy loams that are underlain by sedimentary rock at a depth of 11 to 19 inches. These soils lie on uplands and have slopes of 15 to 75 percent. Vegetation is mainly brush or hardwoods that have an understory of dense brush. Elevation ranges from 1,600 to 4,000 feet. Average annual rainfall is 30 to 50 inches, and average annual temperature is 55° to 56° F. The growing season is about 200 to 250 days. Maymen soils are associated with the Los Gatos and Madonna soils.

In a representative profile, the surface layer is brown, medium acid fine sandy loam about 3 inches thick. The subsoil is light-brown, strongly acid fine sandy loam that is underlain at a depth of 14 inches by very pale brown, strongly acid, hard, fractured sandstone. In some areas rock outcrops cover 5 to 10 percent of the surface.

Maymen soils are used for range, wildlife, recreation, and watershed.

Maymen rocky fine sandy loam, 50 to 75 percent slopes, eroded (MfG2).—This soil is on uplands and has slopes that average about 60 percent.

Representative profile (on ridge between Eastman and Murphy Canyons, 2 miles east of Mt. Madonna Road; SW¼SW¼ sec. 15, T. 10 S., R. 2 E.):

O1—1 inch to 0, undecomposed leaves, pine needles, and twigs; abrupt, smooth boundary. (1 to 2 inches thick.)

A1—0 to 3 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate, fine, granular structure; soft, very friable, nonsticky and nonplastic; few fine and very fine roots; many very fine interstitial pores; medium acid (pH 5.6); abrupt, smooth boundary. (1 to 4 inches thick.)

B2—3 to 14 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak, medium and fine, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few, fine, medium, and coarse roots; many very fine interstitial pores and few medium and fine tubular pores; strongly acid (pH 5.1); clear, wavy boundary. (10 to 15 inches thick.)

R—14 inches, very pale brown, strongly acid, hard, fractured sandstone.

The A horizon is brown, pale brown, or yellowish brown. Reaction is medium acid to strongly acid. Texture is fine sandy loam, loam, or sandy loam. About 5 to 10 percent of the surface is rock outcrops. Depth to sandstone or shale ranges from 11 to 19 inches.

Included with this soil in mapping are some areas of Los Gatos gravelly loam, small areas of Rock land, and a few areas that have slopes ranging to 80 percent.

This soil has an available water holding capacity of 1 to 3 inches. Permeability is moderately rapid. Runoff is very rapid, and the hazard of erosion is moderate or severe. Effective rooting depth is shallow. Fertility is low.

This soil is used for wildlife, recreation, and watershed. Vegetation is mostly brush, but there are a few trees near the drainage channels or on north slopes. Capability unit VIIe-7 (15); range site, Shallow Gravelly Loam.

Maymen fine sandy loam, 15 to 50 percent slopes, eroded (MeF2).—This soil is along ridgetops and has an average slope of about 35 percent. Rock outcrops cover less than 5 percent of the surface.

Included with this soil in mapping are small areas of Ben Lomond fine sandy loam and Madonna loam.

The available water holding capacity of this soil is 1 to 3 inches. Runoff is medium to rapid, and the hazard of erosion is high. Effective rooting depth is 13 to 19 inches.

This soil is used mainly for limited range, wildlife, and watershed. A few acres on the lesser slopes have been cultivated to grain hay. A number of summer cabins and mountain homes have been built on this soil. Capability unit VIIe-8 (15); range site, Shallow Gravelly Loam.

Montara Series

The Montara series consists of somewhat excessively drained clay loams that are underlain by serpentine bedrock at a depth of 10 to 16 inches. These soils are on uplands and have slopes of 15 to 50 percent. Vegetation is annual grasses, forbs, and scattered dwarf oaks and Digger pines. Elevation ranges from 800 to 3,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is 200 to 275 days. Montara soils are associated with the Azule, Climara, and Inks soils.

In a representative profile, the soil is dark gray and very dark gray, moderately alkaline clay loam about 13 inches thick that is underlain by greenish gray serpentine bedrock. Rock outcrops cover 5 to 10 percent of the surface.

Montara soils are used mainly for range, wildlife, recreation, and watershed.

Montara rocky clay loam, 15 to 50 percent slopes, eroded (MwF2).—This soil is on broad, well-rounded ridges of the uplands. Average slope is about 30 percent.

Representative profile (in road cut 0.5 mile north of Pigeon Point; T. 8 S., R. 3 E.):

A11—0 to 2 inches, dark-gray (10YR 4/1) clay loam, black (10YR 2/1) moist; moderate, fine and medium, granular structure; hard, friable, sticky and plastic; few fine roots; many fine and very fine tubular pores; moderately alkaline (pH 8.0); clear, wavy boundary. (0 to 2 inches thick.)

A12—2 to 6 inches, very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; moderate, medium, subangular blocky structure; hard, very friable, sticky and plastic; common, very fine roots; many very fine and fine tubular pores; moderately alkaline (pH 8.0); clear, wavy boundary. (4 to 6 inches thick.)

A13—6 to 13 inches, very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; moderate, fine, subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; common fine and very fine tubular pores; moderately alkaline (pH 8.0); abrupt, irregular boundary. (6 to 8 inches thick.)

R—13 inches, greenish-gray serpentine rock.

The A horizon is dark gray to very dark gray. Five to 10 percent of the surface is covered by rock outcrops. Depth to rock is 10 to 16 inches. Reaction is neutral to moderately alkaline and changes little with increasing depth.

Included with this soil in mapping are areas of Inks rocky clay loam and Rock land and areas of soils that are clay throughout the profile.

Available water holding capacity is 2 to 3 inches. Permeability is moderately slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Fertility is low because of an unfavorable calcium-magnesium ratio. Effective rooting depth is shallow to bedrock.

This soil is used for range, wildlife, recreation, and watershed. Capability unit VIIe-9 (15); range site, Serpentine.

Pacheco Series

The Pacheco series consists of poorly drained clay loams that are underlain by sedimentary alluvium. These soils are on low alluvial plains and have slopes of less than 2 percent. The vegetation, where these soils are not cultivated, is annual grasses and forbs. Elevation ranges from 150 to 300 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days. Pacheco soils are associated with the Clear Lake, Yolo, and Willows soils.

In a representative profile, the surface layer is grayish-brown, moderately alkaline clay loam about 16 inches thick. In some places the surface layer is fine sandy loam or silt loam. The surface layer is underlain by mottled, light-gray, moderately alkaline loam and very fine sandy loam to a depth of more than 60 inches. In places the substratum is gravelly. The profile is calcareous in the lower part.

Pacheco soils are used for irrigated sugar beets, row crops, orchards, pasture, and hay.

Pacheco clay loam (Pd).—This soil is level and is in low positions on the alluvial plains. Average slope is less than 2 percent.

Representative profile (in a field 0.1 mile west of pump number 1 on Taix Company ranch):

Ap—0 to 7 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular structure; hard, friable, sticky and plastic; many fine interstitial pores and many fine tubular pores; moderately alkaline (pH 8.0); clear, smooth boundary. (6 to 8 inches thick.)

A1—7 to 16 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; many fine interstitial and tubular pores; moderately alkaline (pH 8.0); clear, smooth boundary. (8 to 10 inches thick.)

C1g—16 to 35 inches, light-gray (10YR 6/1) loam, gray (10YR 5/1) moist; many, fine, distinct, brown (10YR 5/3) mottles, dark brown (10YR 4/3) moist; massive; hard, friable, nonsticky and nonplastic; moderately alkaline (pH 8.3); clear, smooth boundary. (18 to 25 inches thick.

C2g—35 to 60 inches, light-gray (10YR 6/1) very fine sandy loam, gray (10YR 5/1) moist; many, coarse, distinct, brown (10YR 5/3) mottles, dark brown (10YR 3/3) moist; massive; hard, friable, nonsticky and nonplastic; slightly calcareous, moderately alkaline (pH 8.0).

The A horizon is grayish brown to dark gray. Reaction is mildly alkaline to moderately alkaline. Texture is clay loam or silty clay loam. Structure is fine or medium granular or subangular blocky. The C horizon is light brownish gray, light gray, or gray and contains common to many mottles. It is stratified sandy loam to silty clay loam that averages between 10 and 40 percent clay and more than 15 percent sand. Mottling is generally present at an average depth of slightly more than 16 inches.

Included with this soil in mapping are small areas of Clear Lake clay and of soils similar to the Pacheco soils that are calcareous in the surface layer.

The available water holding capacity is 9 to 11 inches. Permeability is moderate. Runoff is very slow, and this soil is flooded about twice every 10 years. The hazard of erosion is none to slight. Fertility is moderate. Effective rooting depth is restricted to a depth of 36 to 50 inches by a seasonal water table.

This soil is used for irrigated row crops, pears, and sugar beets. Capability unit IIw-2 (14).

Pacheco fine sandy loam (Pa).—This soil is in low positions southeast of Gilroy. The surface layer is grayish brown and in places is sandy loam or silt loam.

Included with this soil in mapping are small areas of Clear Lake clay and small spots where neutral salts have accumulated. Along Carnadero Creek, east of Miller railroad siding, about 100 acres of this soil has a muck substratum.

Available water holding capacity is about 9 to 11 inches. This soil is subject to flooding about twice every 10 years.

This soil is used for irrigated row crops, pears, and sugar beets. Capability unit IIw-2 (14).

Pacheco silt loam, drained (Pb).—This soil has a profile that is similar to that of Pacheco clay loam, but the surface layer is silt loam.

Included with this soil in mapping are small areas of Yolo loam and Garretson gravelly loam.

Available water holding capacity is 9 to 11 inches. The effective rooting depth is more than 60 inches, because the water table that existed during soil development has been lowered by irrigation pumping. This soil is flooded about once every 25 years.

This soil is used for irrigated row crops, sugar beets, cherries, prunes, walnuts, hay, and pasture. Capability unit I-1 (14).

Pacheco clay loam, gravelly substratum (Pe).—This soil occurs as gravelly stringers that are intermingled with Pacheco and Campbell soils. The surface layer commonly is grayish brown or dark gray but in places is loam, clay loam, or gravelly clay loam. The water table generally is below a depth of 5 feet as a result of pumping for irrigation. The substratum, below a depth of 36 to 40 inches, is stratified sand and gravel.

Included with this soil in mapping are small areas that have sand and gravel within 20 inches of the surface, and a few areas of pale brown loam overwash 10 to 15 inches thick. A few of these areas have a seasonal water table within 3 feet of the surface that restricts rooting depth.

The available water holding capacity is 7.5 to 9.5 inches. This soil is moderately permeable and has a rapidly permeable substratum. The effective rooting depth is very deep.

This soil is used for irrigated row crops, prunes, and pasture. Capability unit I-1 (14).

Parrish Series

The Parrish series consists of well-drained gravelly clay loams that are underlain by shale at a depth of 24 to 42 inches. These soils are on uplands and have slopes of 9 to 75 percent. The vegetation is grasses, forbs, oak trees, and a few scattered stands of ponderosa pine. Elevation ranges from 1,000 to 3,000 feet. Average annual rainfall is 20 to 30 inches, and average annual temperature is about 54° to 56° F. The growing season is about 200 to 250 days. Parrish soils are associated with the Gaviota and Los Gatos soils.

In a representative profile, the surface layer is reddish-brown, medium acid gravelly light clay loam about 8 inches thick. The subsoil is reddish-brown, strongly acid gravelly clay loam and gravelly clay that are underlain at a depth of 38 inches by weathered, acid, metamorphosed shale.

Parrish soils are used for dryland pasture and range.

Parrish gravelly clay loam, 9 to 30 percent slopes (PfE).—This soil is on uplands and has slopes that average about 20 percent.

Representative profile (in road cut 2.4 miles above Coe Park gate, Pine Ridge; sec. 31, T. 8 S., R. 4 E.):

A1—0 to 8 inches, reddish-brown (5YR 5/3) gravelly light clay loam containing about 15 percent (by volume) medium and fine gravel, dark reddish brown (5YR 3/3) moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial and tubular pores and few medium and fine tubular pores; medium acid (pH 6.0); clear, smooth boundary. (4 to 10 inches thick.)

B1t—8 to 19 inches, reddish-brown (5YR 4/3) gravelly clay loam containing 30 percent (by volume) medium and fine gravel, dark reddish brown (5YR 3/4) moist; weak, medium, subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; many very fine interstitial and tubular pores and few medium and fine tubular pores; common thin clay films on ped surfaces and in pores; strongly acid (pH 5.1); gradual, smooth boundary. (8 to 12 inches thick.)

B2t—19 to 38 inches, reddish-brown (2.5YR 5/4) gravelly clay containing 35 percent (by volume) medium and fine gravel, dark reddish brown (5YR 3/4) moist; weak, medium, subangular blocky structure; very hard, friable, sticky and plastic; many very fine interstitial and tubular pores; continuous, moderately thick clay films on ped surfaces and in pores; strongly acid (pH 5.1); gradual, irregular boundary. (12 to 20 inches thick.)

R—38 inches, weathered, acid metamorphosed shale with reddish-brown, moderately thick clay films along some cleavage planes.

The A horizon commonly is brown or reddish-brown but in places is pale brown. Texture is gravelly clay loam or gravelly loam that contains about 15 to 20 percent (by volume) medium and fine gravel. Reaction is slightly acid to medium acid. The B horizon is reddish brown or yellowish red. Texture is gravelly clay loam or gravelly clay that contains 30 to 40 percent gravel. Reaction is generally strongly acid but ranges to medium acid. Depth to shale ranges from 24 to 42 inches.

Included with this soil in mapping are small areas of Los Gatos gravelly loam along drainageways and of Gaviota loam on the ridges and south slopes.

The available water holding capacity of this soil is about 4 to 6 inches. Permeability in the subsoil is slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil is moderately fertile. Effective rooting depth is moderately deep.

This soil is used for dryland pasture and range. Capability unit IVe-3 (15); range site, Loamy.

Parrish gravelly clay loam, 30 to 50 percent slopes (PfF).—This soil is on uplands and has slopes that average about 35 percent.

Included with this soil in mapping are areas of Gaviota loam and Los Gatos gravelly loam.

Runoff is rapid, and the hazard of erosion is high. Effective rooting depth is 24 to 38 inches.

This soil is used for range. Capability unit VIe-3 (15); range site, Loamy.

Parrish gravelly clay loam, 50 to 75 percent slopes (PfG).—This soil has slopes that average about 50 percent. Depth to bedrock ranges from 24 to 38 inches.

Included with this soil in mapping are areas of Gaviota loam and areas of Rock land.

Runoff is very rapid, and the hazard of erosion is very high.

This soil is used for range. Capability unit VIIe-1 (15); range site, Loamy.

Pleasanton Series

The Pleasanton series consists of well-drained loams that are underlain by old gravelly sedimentary alluvium. These soils are on fans and terraces and have slopes of 0 to 15 percent. The vegetation, where these soils are not cultivated, is chiefly annual grasses and forbs, and there are scattered oak trees. Elevation ranges from 200 to 1,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is about 260 to 275 days. Pleasanton soils are associated with the Arbuckle and Hillgate soils.

In a representative profile, the surface layer is grayish-brown, slightly acid loam about 18 inches thick. In some places the surface layer is gravelly loam. The subsoil is dark grayish-brown, brown, and yellowish-brown, neutral clay loam, gravelly heavy clay loam, and gravelly sandy clay loam.

Pleasanton soils are used mainly for irrigated row crops, orchards, vineyards, dryland hay, pasture, and range. They are also used for housing and commercial development.

Pleasanton loam, 0 to 2 percent slopes (PoA).—This soil is on broad, old fans.

Representative profile (about 10 feet off north side of road on Dryden Avenue, 700 feet east of New Avenue):

Ap—0 to 5 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine interstitial pores and common very fine tubular pores; slightly acid (pH 6.5); abrupt, smooth boundary. (0 to 6 inches thick.)

A1—5 to 18 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine and medium roots; many very fine interstitial pores, common fine tubular pores, and few medium tubular pores; slightly acid (pH 6.5); clear, wavy boundary. (12 to 14 inches thick.)

B1t—18 to 23 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few medium roots; many very fine interstitial and tubular pores; common thin clay films line pores; neutral (pH 7.0); clear, smooth boundary. (4 to 6 inches thick.)

B2t—23 to 44 inches, brown (10YR 5/3) gravelly heavy clay loam, dark brown (10YR 3/3) moist; moderate, medium, subangular blocky structure; very hard, friable, sticky and plastic; few very fine roots; many very fine and fine tubular pores and few medium tubular pores; many moderately thick clay films on ped surfaces and in pores; neutral (pH 7.0); clear, smooth boundary. (20 to 24 inches thick.)

B3t—44 to 66 inches, yellowish-brown (10YR 5/4) gravelly sandy clay loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, sticky and plastic; few medium roots; many very fine and fine interstitial and tubular pores and few medium tubular pores; common thin clay films in pores; neutral (pH 7.0).

The A horizon ranges from brown or grayish brown to dark grayish brown. Texture is typically loam but ranges to a light clay loam that contains 3 to 5 percent (by volume) medium and fine gravel. Reaction is slightly acid to neutral and changes little with depth. The B horizon is brown, grayish brown, dark grayish brown, or yellowish brown. Texture is clay loam, gravelly clay loam, or gravelly sandy clay loam. The C horizon, where present, is lighter and more yellowish than the B horizon. Lime is present in places in the substratum.

Included with this soil in mapping are small areas of Hillgate silt loam and San Ysidro loam and a few areas of soils that are similar to Pleasanton loam and have a medium acid subsoil.

The available water holding capacity of this soil is 9 to 11 inches. Permeability in the subsoil is moderately slow. Runoff is very slow, and the hazard of erosion is none to slight. This soil is moderately fertile. Effective rooting depth is very deep.

This soil is used mainly for irrigated row crops, apricots, prunes, walnuts, and grapes, and for dryland hay and pasture. Large areas are also used for housing and commercial developments. Capability unit I-3 (14).

Pleasanton loam, 2 to 9 percent slopes (PoC).—This soil is on fans. Slope ranges from 3 to 5 percent but is dominantly 2 to 9 percent.

Included with this soil in mapping are areas that have been subject to moderate sheet erosion.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for irrigated row crops, prunes, apricots, grapes, walnuts, dryland hay, and pasture. Large areas of this soil are also used for housing and commercial development. Capability unit IIe-1 (14).

Pleasanton gravelly loam, 0 to 2 percent slopes (PpA).—This soil has a profile similar to that of Pleasanton loam, 0 to 2 percent slopes, except that it has a gravelly loam surface layer. The content of gravel averages between 15 to 20 percent by volume.

Included with this soil in mapping are small areas of Cropley clay and San Ysidro loam.

The available water holding capacity of this soil is about 8 to 9 inches.

This soil is used mainly for irrigated row crops, apricots, prunes, walnuts, grapes, dryland hay, and pasture. It is also used for housing and commercial development. Capability unit IIs-4 (14).

Pleasanton gravelly loam, 2 to 9 percent slopes (PpC).—This soil is in small to medium-sized areas on the upper parts of older alluvial fans. Average slope is 3 to 5 percent. Content of gravel averages between 15 to 25 percent by volume.

Included with this soil in mapping are small areas of Cropley clay, Hillgate silt loam, and Garretson gravelly loam.

The available water holding capacity of this soil is 8 to 9 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Except for areas in small upland valleys, most of this soil is cultivated. It is used for row crops, irrigated prunes, apricots, grapes, walnuts, dryland hay, and pasture. Capability unit IIe-1 (14).

Pleasanton gravelly loam, 9 to 15 percent slopes, eroded (PpD2).—This soil is on terraces on uplands. Average slope is 12 percent. Content of gravel is 15 to 25 percent by volume.

Included with this soil in mapping are small areas of Hillgate silt loam, and areas that have been subject to severe sheet erosion.

The available water holding capacity is 6 to 7 inches. Runoff is medium, and the hazard of erosion is moderate.

This soil is used for dryland hay, pasture, and range. Capability unit IVe-1 (15); range site, Loamy.

Rincon Series

The Rincon series consists of well-drained clay loams that are underlain by sedimentary alluvium. These soils are on fans and have slopes of 0 to 9 percent. Vegetation, where these soils are not cultivated, is chiefly annual grasses and forbs, and there are scattered large oak trees. Elevation ranges from 200 to 1,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is about 58° to 60° F. The growing season is 250 to 275 days. The Rincon soils are associated with the Cropley and Pleasanton soils.

In a representative profile, the surface and subsurface layers are dark-gray, neutral and mildly alkaline clay loam about 19 inches thick. The subsoil is grayish-brown, mildly alkaline and moderately alkaline gravelly clay and clay and is underlain at a depth of 50 inches by light yellowish-brown, moderately alkaline, calcareous clay loam.

Rincon soils are used for irrigated row crops, apricots, prunes, walnuts, grapes, dryland hay, and pasture.

Rincon clay loam, 0 to 2 percent slopes (RaA).—This soil is on broad fans.

Representative profile (about 126 feet south on Ferguson Road from the intersection with Godfrey Road):

Ap—0 to 6 inches, dark-gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; massive; hard, friable, sticky and plastic; many very fine roots; many very fine interstitial and tubular pores; neutral (pH 7.0); clear, smooth boundary. (6 to 7 inches thick.)

A1—6 to 12 inches, dark-gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; massive; very hard, friable, sticky and plastic; few very fine and fine roots; many fine and very fine interstitial pores and many fine tubular pores; neutral (pH 7.0); clear, wavy boundary. (6 to 7 inches thick.)

A3—12 to 19 inches, dark-gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; massive; hard, friable, sticky and plastic; few fine and medium roots; many fine and very fine interstitial pores and many fine tubular pores; many thin clay bridges between sand grains; mildly alkaline (pH 7.5); clear, wavy boundary. (7 to 8 inches thick.)

B2t—19 to 37 inches, grayish-brown (2.5Y 5/2) gravelly clay, dark grayish brown (2.5Y 4/2) moist; strong, coarse, prismatic structure; very hard, firm, sticky and plastic; few fine roots; many very fine interstitial and tubular pores and many fine interstitial pores; continuous thin and moderately thick clay films on ped surfaces and in pores; mildly alkaline (pH 7.5); clear, wavy boundary. (16 to 20 inches thick.)

B3t—37 to 50 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong, medium, subangular blocky structure; very hard, firm, sticky and plastic; many very fine interstitial and tubular pores; many thin and moderately thick clay films on ped surfaces and in pores; slightly calcareous; moderately alkaline (pH 8.0); clear, wavy boundary. (12 to 16 inches thick.)

Cca—50 to 72 inches, light yellowish-brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, sticky and plastic; many very fine and fine interstitial and tubular pores; calcareous; moderately alkaline (pH 8.0).

The A horizon is typically dark gray but ranges to dark grayish brown and grayish brown. Texture is clay loam or silty clay loam, and the reaction is slightly acid to mildly alkaline. The B horizon is dark grayish brown or grayish brown. Texture is clay, gravelly clay, or gravelly heavy clay loam, and the reaction is mildly alkaline to moderately alkaline. The C horizon is yellowish-brown or light yellowish-brown gravelly clay loam or clay loam.

Included with this soil in mapping are a few areas of Pleasanton gravelly loam and Hillgate silt loam, and a few small areas of brown clay loams that are similar to the Rincon soils.

The available water holding capacity is about 9 to 11 inches. Permeability in the subsoil is slow. Runoff is very slow, and erosion is not a hazard. Fertility is high. Effective rooting depth is very deep but is somewhat restricted by the clay subsoil.

This soil is used for irrigated row crops, grapes, apricots, prunes, walnuts, dryland hay, and pasture. Capability unit IIs-3 (14).

Rincon clay loam, 2 to 9 percent slopes, eroded (RaC2).—This soil is on fans and has dominantly 3 to 6 percent slopes. The surface layer is grayish brown.

Included with this soil in mapping are a few areas of Rincon soils that have a gravelly clay loam surface layer, Cropley clay, and Hillgate silt loam.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for irrigated row crops, prunes, apricots, walnuts, grapes, dryland hay, and pasture. Capability unit IIe-3 (14).

Riverwash

Riverwash (Rg) is a mixture of sand, gravel, and cobblestones that contains little or no silt and clay. It is the loose mass of material that occupies stream channels and is exposed at low water. Riverwash is subject to movement in spring during periods of runoff and during stream flooding. The vegetation consists of willows, sycamore trees, oak trees, herbs, and clumps of perennial and annual grasses.

Included with this land type along the major drainageways are fine-textured to medium-textured materials of very steep to vertical streambanks that are actively eroding and sloughing.

Riverwash has little value for farming; however, a few areas may have limited use as wildlife habitat. A few areas along the larger streams are used as a source of sand and gravel. Capability unit VIIIw-4 (14, 15).

Rock Land

Rock land (RnG) consists of areas in which outcroppings of sedimentary or igneous rock cover 25 percent or more of the surface. Thickness and texture of the soil material between the rock outcroppings is variable. Slopes are 50 to 75 percent. Vegetation is mainly brush.

Included with this land type are areas of Vallecitos rocky loam, Gaviota loam, and Montara rocky clay loam.

This land type is used mainly for wildlife, recreation, and watershed. Capability unit VIIIs-1 (15).

San Andreas Series

The San Andreas series consists of well-drained fine sandy loams that are underlain by sandstone bedrock at a depth of 22 to 30 inches. These soils lie on uplands and have slopes of 15 to 75 percent. The vegetation, where these soils are not cultivated, is annual grasses and forbs, scattered live oak trees, and patches of coastal sage. Elevation ranges from 400 to 2,500 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is about 58° to 60° F. The growing season is about 200 to 250 days. San Andreas soils are associated with the Los Osos and San Ysidro soils.

In a representative profile, the surface layer is grayish-brown, medium acid fine sandy loam about 14 inches thick. The subsoil is light brownish-gray, medium acid sandy loam that is underlain at a depth of about 23 inches by pale-brown, coarse-grained soft sandstone.

San Andreas soils are used for dryland vineyards and range.

San Andreas fine sandy loam, 30 to 75 percent slopes, eroded (SaG2).—This soil is on uplands, and in places some slopes are more than 75 percent.

Representative profile (about 100 feet up on south-facing hillside from intersection of Burchell Road and State Highway 152, Hecker Pass) :

O1—1 inch to 0, partially decomposed leaves, needles, and twigs; abrupt, smooth boundary.

A11—0 to 5 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; strong, fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores and common fine tubular pores; medium acid (pH 6.0) ; clear, wavy boundary. (4 to 8 inches thick.)

A12—5 to 14 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few medium and coarse roots; many very fine interstitial and tubular pores, and few medium tubular pores; medium acid (pH 6.0) ; clear, wavy boundary. (8 to 10 inches thick.)

B2—14 to 23 inches, light brownish-gray (10YR 6/2) sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few medium and coarse roots; many very fine interstitial and tubular pores and few medium tubular pores; few thin clay coatings on sand grains and clay films in pores; medium acid (pH 6.0) ; clear, regular boundary. (10 to 12 inches thick.)

C—23 inches, pale-brown, coarse-grained soft sandstone.

The A horizon is commonly grayish brown but ranges to brown. North slopes are generally dark grayish brown. Reaction is slightly acid to medium acid. Texture of the A horizon is commonly fine sandy loam but ranges from sandy loam to very fine sandy loam. The B horizon is light brownish gray or pale brown. Reaction is slightly acid to medium acid. Texture of the B horizon is similar to that of the A horizon, but it commonly contains slightly more clay; however, the increase is less than 3 percent. Soft sandstone is at depth of 22 to 30 inches.

Included with this soil in mapping are small areas that have been subject to severe sheet and rill erosion, areas of rock outcrops, and areas of loamy sand.

The available water holding capacity is 3 to 4.5 inches. Permeability is moderately rapid. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. This soil is moderately fertile. Effective rooting depth is moderately deep to soft sandstone.

This soil is used for range. Capability unit VIIe-1 (15) ; range site, Loamy.

San Andreas fine sandy loam, 15 to 30 percent slopes, eroded (SaE2).—This soil has an average slope of about 20 percent.

Included with this soil in mapping are some areas that have many shallow gullies and areas where the substratum is exposed.

Runoff is rapid, and the hazard of erosion is high.

This soil is used for dryland grapes and range. Capability unit VIe-1 (15) ; range site, Loamy.

San Benito Series

The San Benito series consists of well-drained clay loams that are underlain by calcareous interbedded sandstone and shale at a depth of 20 to 48 inches. These soils lie on uplands and have slopes of 15 to 75 percent. The vegetation is annual grasses and forbs, oak trees, and some brush. Elevation ranges from 400 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is about 58° to 60° F. The growing season is about 200 to 250 days. San Benito soils are associated with the Los Osos and Gaviota soils.

In a representative profile, the surface layer is dark grayish-brown, neutral clay loam about 26 inches thick. The substratum is yellowish-brown, calcareous, moderately alkaline clay loam that is underlain at a depth of 39 inches by yellowish-brown, calcareous shale. In some places these soils are eroded.

San Benito soils are used for watershed, dryland hay, pasture, and range.

San Benito clay loam, 50 to 75 percent slopes (SbG).—This soil is on side slopes in areas of moderately steep soils or in areas of narrow, winding ridgetops. Slopes are dominantly between 50 and 55 percent.

Representative profile (0.7 mile east on Highway 152 from San Felipe Road and about 200 feet north on hillside) :

A11—0 to 5 inches, dark grayish-brown (10YR 4/2) clay loam, dark brown (10YR 3/3) moist; strong, medium, subangular blocky structure, parting to moderate, medium, granular structure; hard, friable, sticky and plastic; many very fine roots; many very fine interstitial and tubular pores and few fine tubular pores; neutral (pH 7.0) ; clear, wavy boundary. (6 to 8 inches thick.)

A12—5 to 26 inches, dark grayish-brown (10YR 4/2) clay loam, dark brown (10YR 3/3) moist; moderate, coarse, subangular blocky structure; very hard, friable, sticky and plastic; common very fine roots; many very fine tubular and interstitial pores and few very fine tubular pores; neutral (pH 7.0) ; diffuse, wavy boundary. (14 to 22 inches thick.)

Cca—26 to 39 inches, yellowish-brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, very friable, sticky and plastic; few very fine roots; many fine and very fine tubular and interstitial pores; calcareous, moderately alkaline (pH 8.0) ; diffuse, wavy boundary. (4 to 18 inches thick.)

R—39 inches, yellowish-brown, calcareous shale.

The A horizon is grayish brown or dark grayish brown to brown. Reaction is neutral to mildly alkaline. Texture of the A horizon is typically clay loam but in places is silty clay loam. The C horizon is pale brown or yellowish brown. Texture is clay loam or silty clay loam. Depth to bedrock ranges from 24 to 48 inches.

Included with this soil in mapping are small areas of Altamont clay, Los Gatos gravelly loam, and Vallecitos rocky loam, and of a soil that is calcareous in the surface layer.

The available water holding capacity of this soil is 5 to 10 inches, depending on depth to bedrock. Permeability is moderately slow. Runoff is very rapid, and the hazard of erosion is very high. This soil has high fertility. Effective rooting depth is moderately deep to deep.

This soil is used for range and watershed. Capability unit VIIe-1(15); range site, Clayey.

San Benito clay loam, 15 to 30 percent slopes, eroded (SbE2).—This soil is moderately steep and lies on rounded ridgetops on uplands. Depth to shale ranges from 32 to 43 inches.

Included with this soil in mapping are a few areas of Altamont clay and Los Gatos gravelly loam, a few areas of soils that are calcareous in the surface layer, and a few severely eroded areas.

Available water holding capacity is 6 to 9 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is used for dryland hay, pasture, and range. Capability unit IVe-1 (15); range site, Clayey.

San Benito clay loam, 30 to 50 percent slopes (SbF).—This soil is on uplands and has an average slope of 35 percent.

Included with this soil in mapping are small areas of Diablo clay that occur in a complex pattern. Runoff is rapid, and the hazard of erosion is high.

This soil is used for range. Capability unit VIe-1 (15); range site, Clayey.

San Benito clay loam, 30 to 50 percent slopes, severely eroded (SbF3).—This soil is along drainageways. Sheet and rill erosion has been severe, and about 4 to 10 inches of the topsoil has been lost. Depth to shale is 20 to 36 inches. Vegetation is mostly grasses, brush, or moderately thick stands of oak trees and brush.

Included with this soil in mapping are some areas of Rock land and landslips.

The available water holding capacity is 4 to 7.5 inches. Runoff is rapid, and the hazard of erosion is high. Natural fertility is moderate.

This soil is used for range. Capability unit VIIe-1 (15); range site, Clayey.

Santa Lucia Series

The Santa Lucia series consists of well-drained shaly loams that are underlain by hard, shattered shale at a depth of 20 to 32 inches. These soils lie on uplands and have slopes of 30 to 75 percent. Vegetation is annual grasses and forbs, oak trees, and brush. Elevation ranges from 500 to 2,000 feet. Average annual rainfall is 20 to 35 inches, and average annual temperature is about 58° to 60° F. The growing season is 200 to 250 days. Santa Lucia soils are associated with the Felton, Los Osos, and Madonna soils.

In a representative profile, the surface layer is gray, medium acid shaly loam and shaly clay loam about 14 inches thick. The subsoil is gray, medium acid very shaly clay loam that is underlain at a depth of about 23 inches by very pale brown fractured shale.

Santa Lucia soils are used for range, wildlife, and watershed.

Santa Lucia shaly loam, 50 to 75 percent slopes (ScG).—This soil is on uplands that have narrow ridgetops. The slope averages between 55 to 75 percent.

Representative profile (1 mile down jeep trail toward Pescadero Creek from Atherton Peak):

A11—0 to 4 inches, gray (10YR 5/1) shaly loam containing 35 percent (by volume) shale fragments, very dark gray (10YR 3/1) moist; strong, medium and fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots, and few medium and coarse roots; many very fine interstitial pores, common fine tubular pores, and few medium tubular pores; medium acid (pH 5.6); clear, smooth boundary. (3 to 6 inches thick.)

A12—4 to 14 inches, gray (10YR 5/1) shaly clay loam containing 40 percent (by volume) medium and fine weathered shale fragments, very dark gray (10YR 3/1) moist; moderate, medium, subangular blocky structure; common very fine and medium roots and few coarse roots; many very fine interstitial pores, common fine tubular pores, and few medium tubular pores; medium acid (pH 5.6); clear, wavy boundary. (9 to 14 inches thick.)

B2—14 to 23 inches, gray (10YR 6/1) very shaly heavy clay loam containing about 60 percent (by volume) medium and fine weathered shale fragments and 10 percent (by volume) larger than 1 inch; dark gray (10YR 4/1) moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots and few coarse roots; many very fine interstitial pores, common fine pores, and few medium tubular pores; medium acid (pH 5.6); abrupt, irregular boundary. (8 to 12 inches thick.)

R—23 inches, very pale brown, hard, fractured Monterey shale.

The A horizon is gray or dark gray. Reaction ranges from strongly acid to medium acid and changes little with depth. Texture is shaly loam or shaly clay loam, and 15 to 60 percent (by volume) is weathered shale fragments. The shale fragments, on working, readily break down to silt and clay-sized materials. Below a depth of 10 inches, the average content of shale fragments is more than 50 percent. Depth to hard, shattered shale bedrock ranges from 20 to 32 inches.

The dark colors in this soil are not so deep in the profile as in the Santa Lucia soils elsewhere in California, but this does not affect its use and management.

Included with this soil in mapping are some areas of Felton silt loam, areas that have been subject to severe sheet erosion, and a few areas where slopes range to 80 percent.

The available water holding capacity is 2 to 4 inches. Permeability is moderate. Runoff is very rapid, and the hazard of erosion is very high. This soil is moderately fertile. Effective rooting depth is moderately deep.

This soil is used for range, wildlife, and watershed. Most of this soil has a dense cover of brush and hardwood. Capability unit VIIe-1 (15); range site, Loamy.

Santa Lucia shaly loam, 30 to 50 percent slopes, eroded (ScF2).—This soil is on uplands and has an average slope of about 35 percent. Most areas of this soil are located in the southwestern part of the survey area, along the Santa Cruz-Santa Clara County line. Because of moderate sheet erosion, the average depth to bedrock is about 21 inches. Vegetation consists of areas of grass, of grass and oak trees, or of brush.

Included with this soil in mapping are areas of Rock land and small areas of shallow, shaly soils. There are also a few areas of soils that have slopes of 15 to 30 percent.

Runoff is rapid, and the hazard of erosion is high. Available water holding capacity averages 2 to 3 inches.

This soil is used for range. Capability unit VIe-1 (15); range site, Loamy.

San Ysidro Series

The San Ysidro series consists of moderately well drained loams that are underlain by old alluvium from material derived from sedimentary rock. These soils are on fans and terraces and have slopes of 0 to 5 percent. The vegetation, where these soils are not cultivated, is chiefly annual grasses and forbs, and there are scattered oak trees. Elevation ranges from 200 to 1,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days. San Ysidro soils are associated with the Pleasanton and Hillgate soils.

In a representative profile, the surface layer is light brownish-gray, medium acid loam that is about 18 inches thick and is underlain by 2 inches of light-gray, slightly acid, mottled loam. The subsoil is mottled, brown and yellowish-brown, slightly acid and neutral clay that is 16 inches thick over light yellowish-brown, calcareous, moderately alkaline clay loam. At a depth of 50 inches, the substratum is mottled, light yellowish-brown, calcareous, moderately alkaline sandy clay loam.

San Ysidro soils are used for irrigated row crops, apricots, prunes, vineyards, dryland hay, and pasture.

San Ysidro loam, 0 to 2 percent slopes (SdA).—This soil is in depressional areas and has smooth slopes.

Representative profile (two tree rows west and nine tree rows south of shop in prune orchard on Alfred Angelino ranch, about 1,500 feet east on Godfrey Avenue from intersection with Furlong Avenue):

Ap—1 to 5 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, nonsticky and slightly plastic; many very fine roots; many very fine interstitial pores; medium acid (pH 6.0); abrupt, smooth boundary. (5 to 10 inches thick.)

A1—5 to 18 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, nonsticky and slightly plastic; few very fine and fine roots; many very fine interstitial and tubular pores and few medium tubular pores; medium acid (pH 6.0); clear, wavy boundary. (12 to 14 inches thick.)

A2—18 to 20 inches, light-gray (10YR 7/2) loam, light brownish gray (10YR 6/2) moist; common, fine, distinct, pale brown (10YR 6/3) mottles, dark brown (10YR 4/3) moist; massive; hard, friable, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial and tubular pores and few medium tubular pores; slightly acid (pH 6.5); abrupt, wavy boundary (1 to 6 inches thick.)

B21t—20 to 28 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; few, medium, faint, yellowish-brown (10YR 5/4) mottles, dark grayish brown (10YR 4/2) moist; moderate, coarse, prismatic structure; very hard, firm, sticky and plastic; many very fine interstitial and tubular pores and few medium tubular pores; many moderately thick clay films on ped surfaces and in pores; slightly acid (pH 6.5); clear, wavy boundary. (8 to 10 inches thick.)

B22t—28 to 36 inches, yellowish-brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; moderate, coarse, prismatic structure; very hard, very firm, sticky and plastic; many fine tubular pores; continuous, moderately thick and thick clay films on ped surfaces and in pores; neutral (pH 7.0); clear, wavy boundary. (8 to 10 inches thick.)

B3t—36 to 50 inches, light yellowish-brown (10YR 6/4) clay loam, yellowish brown (10YR 5/6) moist; weak, medium, subangular blocky structure; very hard, firm, sticky and plastic; many very fine and fine tubular pores and few medium tubular pores; common thin clay films in pores and on ped surfaces; slightly calcareous, moderately alkaline (pH 8.0); gradual, wavy boundary. (12 to 16 inches thick.)

C—50 to 60 inches, light yellowish-brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/6) moist; massive; hard, friable, sticky and plastic; many very fine interstitial and tubular pores and few medium tubular pores; slightly calcareous, moderately alkaline (pH 8.0).

The A1 horizon is light brownish gray or pale brown. Texture is loam or very fine sandy loam. Reaction is medium acid to strongly acid and increases with depth. The A2 horizon ranges from 1 to 6 inches in thickness. The B2t horizon is heavy clay loam or clay. Reaction is slightly acid to mildly alkaline. The C horizon is stratified but is commonly sandy clay loam or gravelly clay loam. It is slightly calcareous in places.

Included with this soil in mapping are small areas of Arbuckle gravelly loam and Pleasanton loam, and about 90 acres, south of Highland Avenue along the west branch of Llagas Creek, that is covered by grayish-brown clay loam overwash.

The available water holding capacity of this soil is 7 to 8 inches. It has a very slowly permeable clay subsoil. During the winter months it becomes ponded. The hazard of erosion is none to slight. Fertility is low. Effective rooting depth generally is very deep.

This soil is used for irrigated row crops, apricots, prunes, and grapes. A few acres are used for dryland grain hay and pasture. Because of the clay subsoil, this soil is best suited to shallow-rooted crops. Capability unit IIIs-3 (14).

San Ysidro loam, 2 to 5 percent slopes, eroded (SdB2).—This soil is on fans and has an average slope of about 4 percent.

Included with this soil in mapping are small areas of Arbuckle gravelly loam and Pleasanton loam.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for dryland grain hay and pasture. Capability unit IIIe-3 (14).

San Ysidro Series, Acid Variant

The San Ysidro series, acid variant, consists of moderately well drained loams formed in old alluvium from sedimentary rock. These soils are on fans and terraces and have slopes of 0 to 9 percent. The vegetation, where these soils are not cultivated, consists chiefly of annual grasses and forbs, and there are scattered oak trees. Elevation ranges from 200 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is 260 to 275 days. These soils are associated with the Hillgate and Pleasanton soils.

In a representative profile, the surface layer is light brownish-gray, medium acid loam about 15 inches thick. It is underlain by a subsurface layer of light-gray, mottled, medium acid loam. At a depth of about 20 inches is a band of mottled and mixed yellowish-brown, pale-brown, and light-gray, medium acid clay loam 9 inches thick. The subsoil is light yellowish-brown and strong-brown, strongly acid clay and gravelly clay loam to a depth of more than 60 inches.

The San Ysidro variant is used for irrigated row crops, apricots, prunes, grapes, and dryland hay and pasture.

San Ysidro loam, acid variant, 0 to 2 percent slopes (SfA).—This soil is on old fans. It is similar to San Ysidro loam, 0 to 2 percent slopes, but has a strongly acid subsoil.

Representative profile (250 feet west of Center Road, 0.6 mile south of Church Street and about 2.25 miles southeast of San Martin):

Ap—0 to 4 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak, fine and medium, subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine interstitial pores and common fine and medium tubular pores; medium acid (pH 6.0); clear, smooth boundary. (4 to 5 inches thick.)

A11—4 to 10 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak, coarse, angular blocky structure; very hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine interstitial pores and common fine and medium tubular pores; slightly compacted because of tillage; medium acid (pH 6.0); gradual, smooth boundary. (6 to 8 inches thick.)

A12—10 to 15 inches, light brownish-gray (10YR 6/2) heavy loam with common, fine, distinct, brown (7.5YR 5/4) mottles, dark grayish brown (10YR 4/2) moist; massive; very hard, friable, sticky and plastic; very few very fine and medium roots; many very fine interstitial pores and common fine and medium tubular pores; few reddish-brown manganese and iron concretions 1 to 2 millimeters thick; medium acid (pH 6.0); clear, smooth boundary. (4 to 6 inches thick.)

A2—15 to 20 inches, light-gray (10YR 7/2) heavy loam with common, fine, distinct, brown (10YR 5/3) mottles; brown (10YR 5/3, 7.5YR 4/2) moist; massive; very hard, friable, sticky and plastic; very few, very fine and medium roots; many very fine interstitial pores and common fine and medium tubular pores; common, fine, very dark reddish-brown manganese and iron concretions 1 to 2 millimeters thick; medium acid (pH 6.0); gradual, wavy boundary. (2 to 8 inches thick.)

B&A—20 to 29 inches, mottled and mixed yellowish-brown, pale-brown, and light-gray (10YR 5/4, 6/3, 7/2) clay loam, dark grayish brown, dark brown, and brown (10YR 4/2, 4/3, 5/3) moist; massive; very hard, firm, sticky and plastic; very few very fine roots; common very fine interstitial pores, common very fine tubular pores, and few fine tubular pores; common, thin clay bridges between sand grains in brownish parts; common, fine, dark reddish-brown to black manganese and iron concretions 1 millimeter thick, mainly in upper part that has mostly light-gray color; medium acid (pH 6.0); gradual, smooth boundary. (2 to 8 inches thick.)

B2t—29 to 42 inches, light yellowish-brown (10YR 6/4) light clay, brown (10YR 5/5, 4/4 rubbed) moist; massive; very hard, firm, and somewhat brittle, sticky and plastic; common very fine interstitial pores, common fine tubular pores, and few very fine and medium tubular pores; many thin clay bridges between sand grains; a few prominent joints that suggest very coarse polygonal prisms have moderately thick yellowish-brown (10YR 5/4) clay films and black manganese stains in a dendritic pattern; strongly acid (pH 5.2); gradual, smooth boundary. (14 to 20 inches thick.)

B3t—42 to 60 inches, strong-brown (7.5YR 5/6) gravelly heavy clay loam, dark brown (7.5YR 4/4) moist; massive; hard, firm, and slightly brittle, sticky and plastic; many very fine interstitial pores and few fine tubular pores; continuous moderately thick clay bridges between sand grains; some joints have moderately thick dark-brown (7.5YR 4/4) clay films, and black manganese veins 1/8 to 3/4 inch across and several inches long; many sandstone pebbles are strongly weathered and are yellowish when cut; strongly acid (pH 5.4); gradual, smooth boundary.

The A horizon is light brownish gray and light gray or grayish brown. Texture is loam or very fine sandy loam but ranges to sandy loam. The B horizon is light yellowish brown, strong brown, or brown. The texture is heavy clay loam or clay. Depth to the very slowly permeable B2t horizon is 18 to 35 inches.

Included with this soil in mapping are a few areas of Hillgate silt loam and Pleasanton loam.

The available water holding capacity is 6 to 9 inches. Runoff is very slow, and the hazard of erosion is none to slight. Fertility is low. Effective rooting depth generally is very deep.

This soil is used for irrigated row crops, apricots, prunes, grapes, dryland hay, and pasture. Capability unit IIIs-3 (14).

San Ysidro loam, acid variant, 2 to 9 percent slopes (SfC).—This soil has an average slope of 5 percent.

Included with this soil in mapping are areas that have been subject to moderate sheet erosion and areas of Hillgate silt loam.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for irrigated row crops, apricots, prunes, and grapes. A few areas are used for dryland hay and pasture. Capability unit IIIe-3 (14).

Sunnyvale Series

The Sunnyvale series consists of poorly drained silty clays that are underlain by alluvium from material derived from sedimentary rock. These soils are in low positions on the alluvial plains and have slopes of less than 2 percent. The vegetation, where these soils are not cultivated, is plants that require much water, annual grasses, and forbs. Elevation ranges from 100 to 300 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days. Sunnyvale soils are associated with the Campbell and Clear Lake soils.

In a representative profile, the surface layer is dark-gray, calcareous, moderately alkaline silty clay about 14 inches thick. It is underlain by light-gray and gray, calcareous, moderately alkaline silty clay to a depth of 60 inches or more. In some places these soils are drained.

Sunnyvale soils are used for irrigated row crops, orchards, and pasture.

Sunnyvale silty clay, drained (Sv).—This soil is on low alluvial plains and has slopes of less than 2 percent.

Representative profile (100 feet west of intersection of Santa Teresa and Laguna Roads, two tree rows north in a prune orchard):

Ap—0 to 6 inches, dark-gray (N 4/0) silty clay, very dark gray (N 3/0) moist; strong, fine, granular structure; hard, very friable, sticky and plastic; common very fine and fine roots; many very fine interstitial pores; slightly calcareous, moderately alkaline (pH 8.0); clear, smooth boundary. (6 to 8 inches thick.)

A1ca—6 to 14 inches, dark-gray (N 4/0) silty clay, very dark gray (N 3/0) moist; strong, fine, subangular blocky structure; hard, friable, sticky and plastic; few fine roots; many very fine interstitial and tubular pores and few fine tubular pores; calcareous, with soft, medium, irregular lime masses; moderately alkaline (pH 8.0); gradual, wavy boundary. (6 to 10 inches thick.)

C1ca—14 to 34 inches, light-gray (N 7/0) silty clay, dark gray (N 4/0) moist; strong, medium, subangular blocky structure; very hard, friable, sticky and plastic; few fine roots; many very fine interstitial and tubular pores; very strongly calcareous, with many, large, irregularly shaped, soft lime masses and few hard lime concretions; moderately alkaline (pH 8.0); gradual, wavy boundary. (18 to 22 inches thick.)

C2gca—34 to 42 inches, gray (5Y 5/1) silty clay, dark gray (5Y 4/1) moist; many, fine, distinct, light yellowish-brown (2.5Y 6/4) mottles, light olive brown (2.5Y 5/4) moist; strong, medium, subangular blocky structure; hard, friable, sticky and plastic; few fine roots; many very fine interstitial and tubular pores; strongly calcareous, with many large, irregularly shaped, soft lime masses; moderately alkaline (pH 8.0); clear, smooth boundary. (8 to 10 inches thick.)

C3g—42 to 60 inches, light-gray (5Y 7/1) silty clay, gray (5Y 5/1) moist; many, fine, distinct, light yellowish-brown (2.5Y 6/4) mottles, light olive brown (2.5Y 5/4) moist; massive; hard, friable, sticky and plastic; many very fine interstitial and tubular pores; weakly calcareous; moderately alkaline (pH 8.0).

The A horizon is silty clay or heavy silty clay loam. The C horizon is typically gray to white, and texture is silty clay or silty clay loam. Lime is disseminated, but there are few to many lime masses and few to common hard lime concretions.

Included with this soil in mapping are some areas of Clear Lake clay and a few small areas that are strongly calcareous in the surface layer.

Available water holding capacity of this soil is 9 to 10 inches. Drainage has been improved because of the general lowering of the water table in the valley. Permeability is slow, and water sometimes is ponded during winter months. Runoff is very slow, and the hazard of erosion is none to slight. Fertility is high. Effective rooting depth is very deep.

This soil is used for irrigated row crops, sugar beets, prunes, and pears. Where orchard crops are grown, definite symptoms of chlorosis are present because of the lime content of the soil. Capability unit IIs-5 (14).

Sunnyvale silty clay (Su).—This nearly level soil has a profile similar to that of Sunnyvale silty clay, drained, but it has a seasonal water table at a depth of 30 to 60 inches. Near Tulare Hill this soil has been flooded twice in about 10 years.

Included with this soil in mapping are a few small areas that are highly calcareous, a few areas that are salty in the surface layer, about 5 acres of Pacheco silt loam, just south of Tulare Hill, and a few acres of Willows clay. About 20 acres of this soil has buried black clay at a depth of 2 to 3 feet.

Effective rooting depth of this soil is very deep but is restricted by the seasonal water table. Available water holding capacity is 9 to 10 inches where this soil is drained. Natural fertility is moderate.

This soil is used for irrigated row crops and pasture. Capability unit IIIw-5 (14).

Terrace Escarpments

Terrace escarpments (TeF) consists of areas of steep, old terraces and generally has slopes of 30 to 50 percent. This land type is associated with the Hillgate, Keefers, and Pleasanton soils. It has not developed distinct horizons, but it generally consists of material of gravelly loam or clay loam texture. Vegetation is mostly annual grasses, forbs, and scattered oak trees.

Runoff is rapid, and the hazard of erosion is high.

This land type is used for limited range, wildlife, and watershed Capability unit VIIe-1 (15); range site, Loamy.

Vallecitos Series

The Vallecitos series consists of well-drained loams that are underlain by sedimentary and metasedimentary bedrock at depths of 13 to 30 inches. These soils are on uplands and have slopes of 15 to 75 percent. Vegetation is annual grasses, forbs, and oak trees. Elevation ranges from 300 to 3,500 feet. Average annual rainfall is about 16 to 25 inches, and average annual temperature is about 58° to 60° F. The growing season is about 200 to 250 days. Vallecitos soils are associated with the Gaviota and Los Gatos soils.

In a representative profile, the surface layer is brown, slightly acid and medium acid loam about 10 inches thick. The subsoil is dark-brown and reddish brown, medium acid clay loam and clay. It is underlain at a depth of 19 inches by bluish-gray metamorphosed shale. Rock outcrops cover 2 to 10 percent of the surface.

Vallecitos soils are used for range, wildlife, recreation, and watershed.

Vallecitos rocky loam, 15 to 30 percent slopes, eroded (VaE2).—This soil is in large areas of steeper soils on hills that have broad, rounded ridges. Slopes average slightly less than 30 percent.

Representative profile (175 feet west from intersection of the county line road from Pacheco Pass Highway):

A11—0 to 2 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; massive; hard, friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial and tubular pores; slightly acid (pH 6.5); clear, smooth boundary. (1 to 2 inches thick.)

A12—2 to 10 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 3/2) moist; massive; hard, friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial and tubular pores and few fine and medium tubular pores; medium acid (pH 6.0); abrupt, smooth boundary. (7 to 8 inches thick.)

B1t—10 to 16 inches, dark-brown (7.5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine interstitial and tubular pores and few fine and medium tubular pores; common thin clay films on bridges between sand grains and clay films in pores; medium acid (pH 6.0); abrupt, broken boundary. (0 to 8 inches thick.)

B2t—16 to 19 inches, reddish-brown (5YR 5/3) clay, dark reddish brown (5YR 3/3) moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; many very fine and fine tubular pores; continuous, moderately thick clay films on ped surfaces and in pores; medium acid (pH 6.0); abrupt, broken boundary. (0 to 12 inches thick.)

R—19 inches, bluish-gray, metamorphosed shale.

The A horizon is brown or grayish brown. Reaction is medium acid to neutral. The texture is loam or light clay loam. Rock outcroppings cover 2 to 10 percent of the surface. The B2t horizon is typically reddish brown but ranges to dark brown or dark reddish brown. Reaction is medium acid to neutral. The texture is clay loam or clay. The Bt horizon is missing in places or is only in fracture planes of the bedrock. Depth to bedrock is 16 to 30 inches.

Included with this soil in mapping are similar soils that have a brown subsoil, small areas of Rock land, areas that have been subject to severe sheet and rill erosion, and small areas of Montara rocky clay loam and Gaviota rocky loam. Also included are areas along drainageways where slopes range up to 45 percent, a few areas of a gray, moderately alkaline soil, and areas that have soft serpentine shale at a depth of 4 feet or more.

The available water holding capacity is 3 to 6 inches, depending on depth to bedrock. Permeability in the subsoil is slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Natural fertility is moderate. Effective rooting depth is shallow to moderately deep to bedrock.

This soil is used for range. Natural vegetation is mostly grasses, forbs, and scattered oak trees. The surface over much of the area is crusted from being trampled by livestock. Capability unit VIe-7 (15); range site, Shallow Loamy.

Vallecitos rocky loam, 50 to 75 percent slopes, eroded (VaG2).—This soil is on uplands that have narrow, somewhat angular to rounded, winding ridgetops. Slopes generally range from 50 to 60 percent. This soil has a profile similar to that of Vallecitos rocky loam, 15 to 30 percent slopes, eroded, but it is more shallow. It averages about 16 inches to bedrock but ranges from 13 to 24 inches.

Included with this soil in mapping are some areas of Gaviota rocky loam and, on the north slopes, Los Osos clay loam.

The available water holding capacity is 2 to 5 inches. Runoff is very rapid, and the hazard of erosion is very high.

This soil is used for range, wildlife, recreation, and watershed. Natural vegetation is generally grasses, forbs, and scattered oak and Digger pine trees, but some of the more eroded areas have a thin brush cover. Capability unit VIIe-7 (15); range site, Shallow Loamy.

Willows Series

The Willows series consists of poorly drained clays that are underlain by alluvium from material derived from sedimentary rock. These soils are in low positions on the alluvial plains and have slopes of less than 2 percent. The vegetation, where these soils are not cultivated, consists of saline-alkali tolerant grasses and forbs. Elevation ranges from 100 to 400 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is about 250 to 275 days. Willows soils are associated with the Clear Lake and Pacheco soils.

In a representative profile, the surface layer is dark-gray, moderately alkaline, calcareous clay about 12 inches thick. The substratum is mottled, olive-gray and light olive-gray, strongly alkaline, calcareous clay to a depth of 60 inches or more. Deep cracks develop in the surface layer and upper part of the substratum when these soils are dry. The soils contain slight to moderate concentrations of soluble salts and alkali salts.

Willows soils are used for irrigated row crops and pasture.

Willows clay (Wa).—This soil is in low positions on alluvial plains. It has no well-defined drainage channels. Slopes are less than 2 percent.

Representative profile (south on Frazer Lake Road, 3/8 of a mile from Bloomfield Avenue intersection and 3/8 of a mile north into field, toward the Pajaro River):

Ap—0 to 6 inches, dark-gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; moderate, medium and fine, granular structure; very hard, firm, sticky and very plastic; few very fine and medium roots; many very fine interstitial and tubular pores and few medium tubular pores; slightly calcareous, moderately alkaline (pH 8.0); abrupt, smooth boundary. (4 to 7 inches thick.)

A1—6 to 12 inches, dark-gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; few, fine, distinct, light brownish-gray (2.5Y 6/2) mottles, light olive brown (2.5Y 5/4) moist; strong, coarse, angular, blocky structure; extremely hard, very firm, sticky and very plastic; many very fine roots and few medium roots; many very fine interstitial and tubular pores and few medium tubular pores; many intersecting slickensides; slightly calcareous, moderately alkaline (pH 8.0); clear, smooth boundary. (6 to 8 inches thick.)

C1ca—12 to 31 inches, olive-gray (5Y 5/2) clay, dark olive gray (5Y 3/2) moist; many, fine, distinct, brown (10YR 5/3) mottles, dark brown (10YR 4/3) moist; strong, coarse, prismatic structure; extremely hard, very firm, sticky and very plastic; common very fine and medium roots; many very fine interstitial and tubular pores and few medium tubular pores; many intersecting slickensides; strongly effervescent, with lime in seams and soft masses; few medium-sized gypsum crystals lining some pores; strongly alkaline (pH 8.5); clear, smooth boundary. (18 to 25 inches thick.)

C2—31 to 60 inches, light olive-gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; common, fine, distinct, brown (10YR 5/3) mottles, dark brown (10YR 4/3) moist, and few, medium, distinct, gray (5Y 5/1) mottles; massive; very hard, firm, sticky and plastic; many very fine interstitial and tubular pores and few medium tubular pores; many intersecting slickensides in the upper 10 inches; strongly effervescent; strongly alkaline (pH 8.5).

The A horizon is commonly dark gray or dark grayish brown. Lime is generally present. Few to many medium-sized salt crystals commonly are in the A and C horizons. When this soil is dry, deep cracks develop that ordinarily are ½ to 1½ inches in width. The C horizon is olive gray, light olive gray, or light yellowish brown. Distinct mottles start at an average depth of 12 inches and are light brownish gray, brown, or gray.

Included with this soil in mapping are some areas of Clear Lake clay and a few areas of a soil that has 2 to 5 percent slopes. About 20 percent of this acreage is covered by overwash material, 10 to 20 inches thick, of sandy clay loam texture.

The natural fertility of this soil is affected by moderate concentrations of soluble salts. Effective rooting depth is restricted by a water table that fluctuates seasonally between depths of 20 and 40 inches. The soil generally is ponded during winter. The available water holding capacity is 6 to 7.5 inches. Permeability is slow, and erosion is not a problem.

This soil is used mostly for pasture. A few areas are used for irrigated row crops. Capability unit IVw-6 (14).

Yolo Series

The Yolo series consists of well-drained loams that are underlain by alluvium from sedimentary rock. These soils are on alluvial plains and fans and have slopes of 0 to 9 percent. The vegetation, where these soils are not cultivated, is mainly annual grasses and forbs, and there are a few scattered oak trees. Elevation ranges from 400 to 2,400 feet. Average annual rainfall is 15 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is about 250 to 275 days. Yolo soils are associated with the Campbell, Esparto, and Zamora soils.

In a representative profile, the surface layer is grayish-brown, neutral and mildly alkaline loam about 29 inches thick. The substratum is brown, mildly alkaline silt loam to a depth of 60 inches or more. In some places the surface layer is silty clay loam.

Yolo soils are used mainly for irrigated row crops, orchards, vineyards, dryland hay, and pasture. Large areas are also used for housing and commercial development. These are the most productive soils in the Santa Clara Valley.

Yolo loam, 0 to 2 percent slopes (YaA).—This soil is on alluvial plains and fans. Representative profile (in field 20 feet east of San Antonio Creek, 0.25 mile north of Harney School, in San Antonio Valley in northwest corner of NW¼NE¼ sec. 1, T. 7 S., R. 4 E.):

Ap—0 to 7 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; neutral (pH 6.6); clear, smooth boundary. (6 to 8 inches thick.)

A1—7 to 29 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial and tubular pores and few fine and medium tubular pores; mildly alkaline (pH 7.5); clear, smooth boundary. (20 to 24 inches thick.)

C—29 to 60 inches, brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; massive; hard, friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial and tubular pores and few medium and fine tubular pores; mildly alkaline (pH 7.5).

The A horizon is grayish brown or brown. Texture is commonly loam but in places is silt loam or light clay loam. Reaction is mildly alkaline to slightly acid. The C horizon is brown, yellowish brown, or light yellowish brown. Reaction is neutral to mildly alkaline. The C horizon is stratified and is silt loam, silty clay loam, clay loam, or loam in texture. This horizon has an average texture of silt loam or loam and is 10 to 40 inches deep. Lime is present in the C horizon below a depth of 40 inches in places.

Included with this soil in mapping are areas of Yolo silty clay loam, areas of a soil that is pale brown in the surface layer, areas of Zamora clay loam, and areas of Garretson soils.

Available water capacity is about 10 to 11 inches. Permeability is moderate. Runoff is very slow, and the hazard of erosion is none to slight. Fertility is high. The effective rooting depth is very deep.

This soil is used partly for irrigated row crops, prunes, apricots, walnuts, pears, dryland hay, and pasture. About 50 percent of the acreage of this soil is used for housing and commercial development. Capability unit I–1 (14) and IIIc–1 (15).

Yolo loam, 2 to 5 percent slopes (YaB).—This soil is on small to medium-sized fans. It has a profile similar to that of Yolo loam, 0 to 2 percent slopes, except that the texture of the surface layer is loam or light clay loam.

Included with this soil in mapping are areas of Garretson gravelly loam and Yolo loam that have slopes that range to 9 percent.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated row crops, prunes, apricots, walnuts, dryland hay, and pasture. Capability unit IIe–1 (14) and IIIe–1 (15).

Yolo silty clay loam, 0 to 2 percent slopes (YeA).—This soil is on alluvial plains. Texture of the surface layer and substratum is silty clay loam or clay loam.

Included with this soil in mapping are small areas of Garretson gravelly loam, narrow areas of slope breaks, and areas of Campbell silty clay loam.

Available water holding capacity is 11 to 12 inches. Permeability is moderately slow. Runoff is very slow, and erosion is not a problem.

This soil is used partly for irrigated row crops, prunes, apricots, walnuts, pears, grapes, and dryland hay and pasture. About 50 percent of the acreage of this soil is used for housing and commercial development. Capability unit I–1 (14).

Yolo silty clay loam, 2 to 9 percent slopes (YeC).—This soil is on alluvial fans and has slopes that average 5 percent. It has a profile similar to that of Yolo loam, 0 to 2 percent slopes, but the surface layer and substratum are silty clay loam or clay loam.

Included with this soil in mapping are some areas of Garretson gravelly loam and Pleasanton gravelly loam.

Available water holding capacity is 11 to 12 inches. Permeability is moderately slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for irrigated row crops, prunes, apricots, walnuts, pears, grapes, and dryland pasture. Capability unit IIe–1 (14).

Zamora Series

The Zamora series consists of well-drained clay loams that are underlain by alluvium of mixed origin. These soils have slopes of 0 to 9 percent and are on alluvial fans. The vegetation, where these soils are not cultivated, is chiefly annual grasses and forbs, and there are scattered oak trees. Elevation ranges from 200 to 1,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is about 250 to 275 days. Zamora soils are associated with the Pleasanton and Yolo soils.

In a representative profile, the surface layer is dark grayish-brown, neutral clay loam about 15 inches thick. In some places the surface layer is loam. The subsoil is dark-brown and brown, neutral clay loam that is underlain at a depth of 35 inches by brown and pale-brown, neutral sandy clay loam and gravelly sandy clay loam that extend to a depth of 60 inches or more.

Zamora soils are used mainly for irrigated row crops, orchards, vineyards, and dryland hay and pasture. A few areas are used for housing and commercial development.

Zamora clay loam, 0 to 2 percent slopes (ZbA).—This soil is on alluvial fans in the Paradise Valley area and in smaller areas throughout the survey area.

Representative profile (in prune orchard about 30 feet southwest of intersection of Bowden Avenue and Watsonville Road):

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, sticky and plastic; few very fine roots; many very fine interstitial pores; neutral (pH 7.0); abrupt, smooth boundary. (6 to 8 inches thick.)

A1—7 to 15 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, sticky and plastic; few very fine and medium roots; neutral (pH 7.0); clear, smooth boundary. (6 to 12 inches thick.)

B21t—15 to 26 inches, dark-brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; few very fine and medium roots; many very fine interstitial and tubular pores and few medium tubular pores; continuous, thick clay film on ped surfaces and in pores; neutral (pH 7.0); clear, wavy boundary. (11 to 14 inches thick.)

B22t—26 to 35 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; few, fine, faint, yellowish-brown (10YR 5/4) mottles, dark yellowish brown (10YR 4/4) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; many very fine interstitial and tubular pores and few medium tubular pores; many thin clay films on ped surfaces and in pores; neutral (pH 7.0); clear, smooth boundary. (9 to 16 inches thick.)

C1—35 to 58 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, sticky and plastic; many very fine interstitial and tubular pores; neutral (pH 7.0); clear, smooth boundary. (20 to 30 inches thick.)

C2—58 to 70 inches, pale-brown (10YR 6/3) gravelly sandy clay loam containing about 30 percent (by volume) gravel, brown (10YR 5/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many fine and very fine interstitial pores; neutral (pH 7.0).

The A horizon is commonly dark grayish brown but in places is grayish brown or dark brown. Texture of the A and B horizons is clay loam or silty clay loam. There is a slight increase in the content of clay from the A horizon to the B horizon. Reaction is neutral to slightly acid and changes little with depth.

Included with this soil in mapping are some areas of Pleasanton loam and small bodies of Yolo loam.

Available water holding capacity is 11 to 12 inches. Runoff is very slow, and the hazard of erosion is none to slight. Permeability in the subsoil is moderately slow. Fertility is high. Effective rooting depth is very deep.

This soil is used for irrigated row crops, prunes, apricots, walnuts, grapes, and dryland hay and pasture. Capability unit I-3 (14).

Zamora loam, 0 to 2 percent slopes (ZaA).—This soil is on small fans throughout the survey area. The surface layer is grayish brown, and the texture is loam or light clay loam that contains about 3 to 8 percent (by volume) medium and fine gravel.

Included with this soil in mapping are areas of Pleasanton loam and Yolo loam.

This soil is used mainly for irrigated row crops, apricots, prunes, walnuts, grapes, and dryland hay and pasture. A few acres are used for housing and commercial development. Capability unit I-3 (14).

Zamora loam, 2 to 9 percent slopes (ZaC).—This soil has an average slope between 3 to 6 percent. The surface layer is grayish brown. Texture is loam or light clay loam that contains about 3 to 8 percent (by volume) medium and fine gravel.

Included with this soil in mapping are areas of Hillgate silt loam and Pleasanton loam.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for irrigated row crops, apricots, prunes, walnuts, grapes, and dryland hay and pasture. Capability unit IIe-1 (14).

Zamora clay loam, 2 to 9 percent slopes (ZbC).—This soil is in small to medium-sized areas on fans. Average slope is 3 to 5 percent. Texture is silty clay loam, clay loam, or gravelly clay loam.

Included with this soil in mapping are areas of gravelly clay loam and gravelly loam.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for irrigated row crops, prunes, apricots, walnuts, grapes, and dryland pasture and hay. Capability unit IIe-1 (14).

Zamora and Cropley soils, 2 to 9 percent slopes, severely eroded (ZeC3).—These soils are on fans and toe slopes. Slopes are mostly short and run toward deeply cut channels. These soils have been damaged by severe gully and sheet erosion.

The Zamora clay loam has a profile similar to that of Zamora clay loam, 0 to 2 percent slopes, and the Cropley clay has a profile similar to that of Cropley clay, 0 to 2 percent slopes.

Included with this mapping unit are areas of Azule clay loam, Diablo clay, and Los Osos clay loam.

Zamora and Cropley soils are used for dryland pasture. Uneven surfaces, gullies, and deposition make cultivation of these soils difficult. Capability unit IVe-5 (15).

Use and Management of the Soils

Soil productivity depends on the characteristics of the soils, the climate of the area in which they occur, and the management they receive. The characteristics of the soils and the climate generally cannot be changed. Management, however, can be controlled, and changes in the systems of management can cause the productivity and quality of crops or livestock products to vary greatly. Changes in management systems are made by varying one or more of many practices, including crop rotation, irrigation, land leveling, fertilization, tillage, erosion control, and drainage.

In this section the system of capability grouping used by the Soil Conservation Service is explained and suggestions for managing soils in each capability group are given. Following this, the Storie Index rating is discussed and the yields of the soils for the more important crops in the survey area are given. This is followed by subsections on range, wildlife, and engineering uses of the soils.

Capability Groups of Soils

Capability classification is the grouping of soils to show, in a general way, their suitability for most kinds of farming. It is a practical classification based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment. The classification does not apply to rice and other crops having special requirements. The soils are classified according to degree and kind of permanent limitation, but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soils; and without consideration of possible but unlikely major reclamation projects.

In the capability system, all kinds of soils are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest grouping, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. Classes are defined as follows:

Class I. Soils that have few limitations that restrict their use.

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.
Class III. Soils that have severe limitations that reduce the choice of plants or require special conservation practices, or both.
Class IV. Soils that have very severe limitations that restrict the choice of plants or require very careful management, or both.
Class V. Soils subject to little or no erosion but that have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife food and cover. (None in the Eastern Santa Clara Area)
Class VI. Soils that have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.
Class VII. Soils that have very severe limitations that make them unsuited to cultivation and that restrict their use largely to grazing, woodland, or wildlife.
Class VIII. Soils and landforms that have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, clayey, or stony; and *c*, used in the Eastern Santa Clara Area but not in all parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only subclasses indicated by *w*, *s*, and *c*, because the soils in it are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils.

Capability units in California are given Arabic numbers that suggest the chief kind of limitation responsible for placement of the soil in the capability class and subclass. For this reason, some of the units within the subclasses are not numbered consecutively, and their symbols are a partial key to some of the soil features. The numerals used to designate units within the classes and subclasses are these:

0. A problem or limitation caused by sand and gravel in the substratum.
1. An erosion hazard, actual or potential.
2. A problem or limitation of wetness caused by poor drainage or flooding.
3. A problem or limitation caused by slow or very slow permeability of the subsoil or substratum.
4. A problem or limitation caused by coarse soil texture or excessive gravel.
5. A problem or limitation caused by a fine textured or moderately fine textured surface soil.
6. A problem of limitation caused by salt or alkali.
7. A problem or limitation caused by cobbles, stones, or rock outcrop.
8. A problem or limitation caused by shallow depth of soil over bedrock.
9. A problem or limitation caused by low fertility or by toxicity.

Land resource areas

In the Eastern Santa Clara Area, capability classification is further refined by designating the land resource area in which the soils in a unit lie. A land resource area is a broad geographic area that has a distinct combination of climate, soils, management needs, and cropping systems. Parts of three of these areas lie in the survey area. These areas and their members are the forested upland soils along the Santa Clara-Santa Cruz County line (4), the Santa Clara Valley (14), and the upland pasture and range soils on both sides of the valley (15).

This section includes a description of each resource area of which part lies in the survey area and assumptions made by land resource areas for capability groupings. Soils in two resource areas may be similar and have the same capability unit and symbol, but use and management may differ. For these reasons capability unit symbols are followed by resource area numbers in parentheses.

Land Resource Area 4 covers the western part of the survey area along the crest of the Santa Cruz Mountains and extends generally 2 to 6 miles eastward. The natural cover is Douglas-fir and redwood. A few areas have been logged. The elevation of this resource area ranges from 500 to 3,500 feet, and the average annual rainfall is 35 to 50 inches.

Major conservation problems in the use of these soils are steep slopes, shallowness to bedrock and a slight to severe hazard of erosion. Fire control, proper logging methods, and sustained yield practices reduce erosion.

Basic facts and assumptions considered in establishing the capability classification for this land resource area are as follows:

1. Climate is characterized by warm summers and cool, moist, mild winters; the frost-free season lasts 200 to 250 days, and the beneficial moisture effects of fog on the plants is equivalent to about 4 inches of annual rainfall.
2. Irrigation is not required, because the soils are mainly managed as forest land.
3. Crops consist primarily of Douglas-fir, redwood, and Christmas trees.
4. Control of flooding is not practical for individual farms and ranches.
5. A moderately high level of management is used.
6. A soil depth of 20 inches and an available water holding capacity of 3 inches are sufficient for annual forage plants.

Land Resource Area 14 consists of the valley bottoms, alluvial fans, and low terraces along the edges of the Santa Clara Valley. This area is level to moderately sloping. The elevation ranges from 100 to 2,400 feet, and the average annual rainfall is 15 to 25 inches.

Many of the soils in this resource area require intensive conservation and management practices if their full potential is to be utilized. The soils at the lower end of the Santa Clara Valley are poorly drained. Flooding and deposition occur along the major streams. Generally the soils do not seriously erode. Maintenance of soil structure requires careful attention on the intensively managed soils. There is a growing shortage of water for irrigation.

Basic facts and assumptions considered in establishing the capability classification for this land resource area are as follows:

1. Climate is characterized by warm summers and cool, moist, mild winters; the frost-free season lasts 250 to 275 days; and beneficial coastal fogs occur over most of the area.
2. Irrigation water is or will be available for all irrigable soils in the area.
3. Land damage by flooding has been greatly reduced, but flooding still occurs in some areas.
4. Drainage has been improved, but more is needed on some soils.
5. A wide variety of the commonly cultivated field, truck, forage, fruit, and nut crops are grown, subject to limitations imposed by individual soils.
6. A moderately high level of management is used.
7. Erosion on the steeper slopes needs to be reduced.

Land Resource Area 15 covers the eastern part of the county that is part of the Diablo Range and the lower foothill areas of the Santa Cruz Mountains. The soils are rolling on hills and are moderately steep to very steep on mountainous uplands. The elevation ranges from 100 to 4,000 feet, and the average annual rainfall is 15 to 50 inches. Natural vegetation is generally grass or oak-grass, but the north slopes are wooded. Most areas of these soils are used for range, wildlife, recreation, and watershed. This is the largest land resource area of the county.

The major conservation needs of this land resource area have been caused by overgrazing and the farming of steep, shallow soils. The soils on the steep slopes have moderate to high erosion hazard and are eroded in many places. Many of the soils are shallow to bedrock, and some are stony and rocky. The low available water holding capacity of many of the soils is caused by shallowness and gravel. Some of the soils derived from serpentine rock have very low fertility.

Basic assumptions considered in establishing the capability classification for the soils in this land resource area are as follows:

1. Irrigation water is not available for any of the soils in the area.
2. Crops are limited and consist primarily of pasture, range, and dryland grain hay.
3. Control of flooding is not practical for individual farms and ranches.
4. A moderately high level of management is used.
5. Soils that have an available water holding capacity of 3 inches are suited to annual forage plants.
6. The evapotranspiration rate, which is the computed amount of water loss under existing conditions of temperature and precipitation for a 12-month period, is 12 to 14 inches.

Management by capability units

In the following pages, the capability units in the Eastern Santa Clara Area are described and suggestions for the use and management of the soils are given. Soil series names are mentioned in each capability unit, but this does not mean that all mapping units in the series are in that particular capability unit.

The soils in each unit are listed in the "Guide to Mapping Units" at the back of this soil survey, and they are more fully described in the section "Descriptions of the Soils."

CAPABILITY UNIT I-1 (14)

This unit consists of very deep, well-drained, nearly level soils on alluvial plains and fans, and soils formed under conditions of poor or somewhat poor drainage that has been altered by pumping for irrigation. Slopes are less than 2 percent. These soils are in the Campbell, Garretson, Pacheco, and Yolo series. They have a loam, silt loam, clay loam, or silty clay loam surface layer and substratum. Also in this unit are the Garretson and Pacheco soils, gravelly substratum, which have stratified sand and gravel at a depth of 36 to 60 inches. Campbell silty clay loam and Pacheco silt loam that have been drained are also in this unit because the seasonal water table that existed during their development is now below the 60-inch root zone.

The soils in this unit are neutral to moderately alkaline throughout the profile. In places the moderately alkaline soils are calcareous in the substratum. Favorable rooting depth is 60 inches or more. Permeability is moderate to moderately slow. Runoff is very slow, and hazard of erosion is none to slight. Fertility is moderate to high. The available water holding capacity is about 7.5 to 12 inches. Average annual rainfall is 15 to 25 inches, and the growing season is 250 to 275 days.

The soils in this unit are the most productive in the survey area and permit a wide range of climatically adapted crops to be grown. These soils are used for orchards, vineyards, dryland hay, pasture, and row crops, including beans, garlic, onions, peppers, lettuce, tomatoes, and sugar beets. The orchard crops are pears, apricots, cherries, prunes, and walnuts.

The soils of this unit have almost no permanent limitations, but leveling cuts must be restricted on Garretson and Pacheco soils, gravelly substratum. It is important to maintain organic-matter content by using green-manure crops, growing crops in suitable rotations, and turning under all crop residue. A good crop rotation for the soils in this unit includes a green-manure crop every 3 to 5 years interchanged with pasture or alfalfa and row crops. In orchards, the green-manure crops need to be planted in fall.

These soils may be irrigated by furrow, border, contour-basin, or sprinkler methods. They can be leveled or graded without difficulty to improve methods of irrigation management where needed. All crops respond well to fertilizer, and a nitrogen fertilizer is especially beneficial for most crops; however, fertilizer needs vary according to the crop.

CAPABILITY UNIT I-3 (14)

This unit consists of very deep, well-drained, nearly level soils that have a moderately fine textured subsoil and are on fans. Slopes average less than 2 percent. These soils are in the Los Robles, Pleasanton, and Zamora series. They have a loam or clay loam surface layer and a gravelly clay loam or clay loam subsoil. The substratum is gravelly sandy clay loam.

The soils in this unit are slightly acid to neutral throughout the profile. Favorable rooting depth is more than 60 inches. Permeability in the subsoil is moderately slow. Runoff is very slow, and erosion is not a hazard. Fertility is moderate or high. The available water holding capacity is 8 to 12 inches. Average annual rainfall is 16 to 20 inches, and the growing season is 250 to 275 days.

These soils are suited to a wide range of climatically adapted crops. They are used for row crops, orchards, vineyards, dryland hay, and pasture. Principal row crops are beans, garlic, onions, peppers, lettuce, and tomatoes. Principal orchard crops are apricots, prunes, and walnuts.

Organic-matter content of these soils can be maintained by including a green-manure crop in the rotation every 3 to 5 years, by returning all crop residue to the soil, and by growing irrigated pasture or alfalfa in rotation with row crops.

These soils may be irrigated by furrow, border, contour-basin, or sprinkler methods. All crops respond well to fertilizer, and a nitrogen fertilizer is especially beneficial for most corps; however, fertilizer needs vary according to the crop. Care must be taken in leveling or smoothing these soils to avoid exposing the subsoil, which is more difficult to manage than the surface layer.

CAPABILITY UNIT IIe-1 (14)

This unit consists of very deep, well-drained, gently sloping to moderately sloping soils that lie on alluvial plains and fans. Slopes range from 2 to 9 percent. These soils are in the Garretson, Los Robles, Pleasanton, Yolo, and Zamora series. They have a loam, gravelly loam, clay loam, and silty clay loam surface layer. Texture of the subsoil or substratum is silt loam, silty clay loam, clay loam, gravelly loam, or gravelly clay loam.

The soils in this unit are slightly acid to mildly alkaline throughout the profile. Favorable rooting depth is 60 inches or more. Permeability is moderately rapid to moderately slow. Runoff is very slow to medium, and the hazard of erosion is none to moderate. Fertility is moderate to high. The available water holding capacity is about 7 to 12 inches. Average annual rainfall is 15 to 25 inches, and the growing season is 250 to 275 days.

These soils are suited to a wide range of climatically adapted crops grown in the survey area. They are used for orchards, row crops, vineyards, dryland hay, and pasture. Principal row crops are beans, garlic, onions, peppers, lettuce, tomatoes, and sugar beets. Principal orchard crops are apricots, prunes, and walnuts.

The soils in this unit can be protected from sheet and gully erosion by tilling across the slope, planting a cover crop, and rotating crops with pasture every 3 to 5 years. Cover crops and all crop residue should be turned under as a green-manure crop to help maintain organic-matter content and improve soil structure.

Because of slopes, these soils are limited to furrow and sprinkler irrigation systems. Where slopes are long or runoff water from higher areas crosses fields, diversions should be provided to convey all excess water to controlled outlets. A nitrogen fertilizer is beneficial to most crops, but need for fertilizer varies according to the crop grown.

CAPABILITY UNIT IIe-3 (14)

Rincon clay loam, 2 to 9 percent slopes, eroded, is the only soil in this unit. This is a very deep, well-drained, gently sloping to moderately sloping soil on fans. It has a clay loam surface layer, a gravelly clay subsoil, and a clay loam substratum.

This soil is neutral in the surface layer and is moderately alkaline and calcareous in the lower part of the subsoil and in the substratum. Roots penetrate to a depth of more than 60 inches. Permeability is slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Natural fertility is high. The available water holding capacity is 9 to 11 inches. The average annual rainfall is 16 to 20 inches, and the growing season is 250 to 275 days.

This soil is suited to almost all climatically adapted crops. It is used for irrigated row crops, prunes, apricots, walnuts, grapes, dryland hay, and pasture. Walnuts are not so well suited as other tree crops because of the slowly permeable clay subsoil.

To slow runoff water and control erosion, all cultivation or tillage should be across the slope. Cover crops in orchards also help to control erosion. Cover crops, green-manure crops, crop residue, or other sources of organic matter should be returned to the soil to improve soil structure and increase the infiltration rate.

Sprinklers are the best method of applying irrigation water, although furrows laid out on the contour or across the slope are also satisfactory.

Applications of a nitrogen fertilizer generally benefit most crops; however, fertilizer needs vary according to the crop and should be determined by soil or plant tissue tests.

CAPABILITY UNIT IIe-5 (14)

Cropley clay, 2 to 9 percent slopes, is the only soil in this unit. This is a very deep, well-drained, gently sloping to moderately sloping soil on fans. It has a clay surface layer and substratum. This soil is neutral to moderately alkaline and is calcareous in the substratum. Favorable rooting depth is more than 60 inches. Permeability is slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Natural fertility is high. The available water holding capacity is about 8.5 to 10 inches. Average annual rainfall is 16 to 20 inches, and the growing season is 260 to 275 days.

The soil in this unit is suited to a wide range of climatically adapted crops grown in the survey area. It is used for row crops, orchards, vineyards, dryland hay, and pasture. Principal row crops are beans, garlic, onions, peppers, lettuce, tomatoes, and sugar beets. Principal orchard crops are apricots, pears, prunes, and walnuts.

The clay surface layer makes this soil difficult to till unless the content of soil moisture is right. This soil can be protected from sheet and gully erosion by tilling and planting across the slope and by rotating crops with pasture every 3 to 5 years. A fall cover crop should be planted in orchards. Cover crops and all crop residue should be returned to the soil to help maintain organic-matter content and improve soil structure. This soil is limited to furrow and sprinkler irrigation systems because of slope.

Fertilizer needs vary according to the crop grown.

CAPABILITY UNIT IIw-2 (14)

This unit consists of deep, poorly drained, nearly level soils on alluvial flood plains. Slopes average less than 2 percent. These soils are in the Pacheco series. They have a fine sandy loam or clay loam surface layer. They have a calcareous, mottled, stratified substratum that is mainly loam and very fine sandy loam in texture.

The soils in this unit are moderately alkaline. Favorable rooting depth is restricted by a seasonal water table at a depth of 3 to 4 feet. Permeability is moderate. Runoff is very slow, and the hazard of erosion is none to slight. A few areas are subject to flooding (fig. 4) about twice in 10 years, which may destroy early crops. Fertility is moderate. The available water holding capacity is 9 to 11 inches. Average annual rainfall is 16 to 20 inches, and the growing season is 250 to 275 days.

These soils are suited to a wide range of climatically adapted shallow-rooted crops. They are used for row crops and pears. Principal row crops grown are beans, garlic, onions, peppers, lettuce, tomatoes, and sugar beets. Except for pears, orchard crops are not well suited unless drainage is improved.

To maintain soil fertility and good soil structure, a crop rotation that includes a grass-legume crop every 3 to 4 years should be used. Also, green-manure crops add needed organic matter.

Because of the low position and poor drainage of these soils, excess water collects on the surface from higher lying areas. Such water should be diverted into suitable outlets. Mole drains, open drains, and tile drains can be used to lower the water table and remove excess water. Irrigation must be controlled to prevent ponding and waterlogging; sprinkler irrigation is the best system for controlling the quantity of water applied. Furrow irrigation should be carefully managed.

All crops respond readily to fertilization, but fertilizer needs vary according to the crop grown.

CAPABILITY UNIT IIs-3 (14)

Rincon clay loam, 0 to 2 percent slopes, is the only soil in this unit. This is a well-drained, nearly level soil on fans. It has a clay loam surface layer, a gravelly clay subsoil, and a clay loam substratum.

This soil is neutral in the upper part and is moderately alkaline and calcareous in the lower part of the subsoil and in the substratum. The favorable rooting depth is more than 60 inches. Permeability is slow. Runoff is very slow, and the hazard of erosion is none to slight. Fertility is high. The available water holding capacity is 9 to 11 inches. Average annual rainfall is 16 to 20 inches, and the growing season is 250 to 275 days.

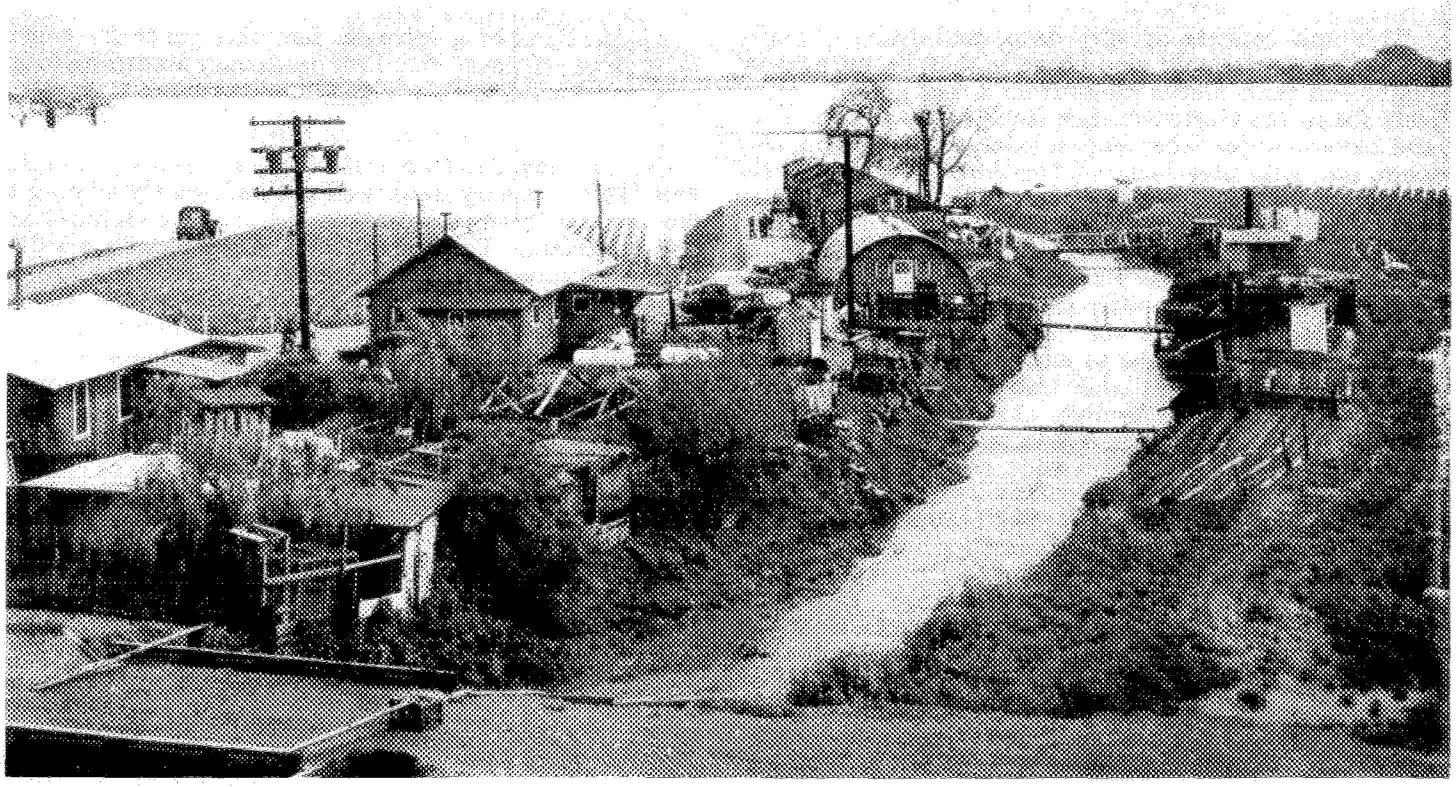

Figure 4.—Flooded area of Pacheco clay loam about 5 miles south of Gilroy.

This soil is suited to a wide variety of climatically adapted crops. It is used for irrigated row crops, grapes, apricots, prunes, walnuts, and dryland hay and pasture. Pears are a well suited tree crop, although other trees do well on this soil. Walnuts are not so well suited as other tree crops because of the slowly permeable gravelly clay subsoil.

Green-manure crops, crop residue, or other sources of organic matter should be returned to the soil to improve soil structure, increase the infiltration rate, and maintain the organic-matter content.

This soil is difficult to till except at the proper moisture content. Water from adjacent areas tends to collect on this soil unless it is protected. All methods of irrigation are suited to this soil; however, furrows need to be carefully managed to assure proper water distribution throughout the profile.

Fertilizer needs vary according to the crop grown and should be determined by plant tissue or soil tests.

CAPABILITY UNIT IIs-4 (14)

This unit consists of very deep, well-drained, nearly level, gravelly soils on fans. Slopes range from 0 to 2 percent. These soils are in the Arbuckle and Pleasanton series. They have a gravelly loam surface layer and a gravelly loam, gravelly clay loam, and gravelly sandy clay loam subsoil. Some areas of these soils have a substratum of very gravelly sandy loam.

The soils in this unit are medium acid to moderately alkaline in both the surface layer and the subsoil. Favorable rooting depth is more than 60 inches. Permeability in the subsoil is moderate to moderately slow. Runoff is very slow, and the hazard of erosion is none to slight. Fertility is moderate. The available water holding capacity is 5 to 8 inches. Average annual rainfall is 15 to 25 inches, and the growing season is 250 to 275 days.

The soils of this unit are suited to a wide range of climatically adapted crops grown in the survey area. Dry-farmed crops, however, are limited because of the moderate to high available water holding capacity. These soils are used for limited row crops, orchards, vineyards, grain hay, and pasture. Principal row crops grown are beans, peppers, and tomatoes. Principal orchard crops are apricots, prunes, and walnuts.

Cover crops and green-manure crops help to maintain soil structure and organic-matter content. All crop residue should be returned to the soil.

There is generally enough gravel present to interfere slightly with tillage operations. Applications of irrigation water must be light and frequent to prevent loss of water by deep percolation. Water can best be applied by using a sprinkler irrigation system. If furrow or border irrigation is used, short runs should be used to prevent excessive percolation and leaching of nutrients from the soil. All crops respond to nitrogen fertilizers, and some crops respond to phosphorus.

CAPABILITY UNIT IIs-5 (14)

This unit consists of very deep, well-drained to poorly drained, nearly level soils on alluvial plains and fans. Slopes average less than 2 percent. These soils are in the Campbell, Clear Lake, Cropley, and Sunnyvale series. They have a clay or silty clay surface layer and substratum.

The soils in this unit are neutral to moderately alkaline in both the surface layer and substratum. In some places the soils are calcareous in the lower part of the surface layer or in the substratum. Favorable rooting depth is more than 60 inches. Permeability in the subsoil is moderately slow to slow. Runoff is very slow, but a few areas of these soils may be ponded during the winter. Fertility is high. The available water holding capacity is about 8 to 12 inches. The water table that existed during the development of the poorly drained and somewhat poorly drained soils is now below the zone that will affect plant roots. The present drainage has been brought about by pumping water for irrigation. Average annual rainfall is 16 to 20 inches, and the growing season is 250 to 275 days.

These soils are suited to a wide range of climatically adapted crops grown in the survey area. They are used for row crops, orchards, vineyards, dryland hay, and pasture. Principal row crops are beans, garlic, onions, peppers, lettuce, tomatoes, and sugar beets. Orchard crops are apricots, prunes, pears, and walnuts. Of the deciduous fruit trees grown in the area, pears are best suited to these soils.

The silty clay or clay surface layer of these soils is difficult to till unless soil moisture is right. To maintain soil fertility and soil structure, a crop rotation should be used. Also, green-manure crops will add needed organic matter.

Because of very slow runoff, excess water from higher lying areas tends to collect on these soils. Such water should be diverted into suitable outlets. Irrigation must be controlled to prevent ponding and waterlogging. Sprinkler irrigation systems can best control the quantity of water applied. Furrow irrigation should be carefully managed.

All crops respond readily to application of fertilizer on these soils; however, fertilizer needs vary according to the crop.

CAPABILITY UNIT IIIe-1 (15)

This unit consists of deep and very deep, well drained and moderately well drained, nearly level to moderately sloping soils on alluvial fans. Slopes range from 0 to 9 percent. These soils are in the Arbuckle, Esparto, Garretson, and Yolo series. They have a gravelly loam and loam surface layer, a gravelly loam, silt loam, and clay loam subsoil, and a very gravelly sandy loam, gravelly clay loam, and silt loam substratum.

Reaction in the surface layer is slightly acid to mildly alkaline. Favorable rooting depth is 38 inches to more than 60 inches. Permeability in the subsoil is moderate to moderately slow. Runoff is very slow to medium, and the hazard of erosion is none to moderate. Fertility is moderate to high. The available water holding capacity is about 5.5 to 12 inches. Average annual rainfall is 15 to 25 inches, and the growing season is 250 to 275 days.

Because irrigation water is not available, the soils in this unit are better suited to climatically adapted dryland crops than to crops requiring irrigation. They are used for dryland grain hay and pasture.

Tillage and planting should be across the slope to slow runoff during rainy seasons. A crop rotation that provides plants with many roots and incorporates crop residue is needed to increase the water infiltration rate and to improve the soil structure. Where slopes are long, or runoff water from higher areas crosses fields, diversions should be provided to convey all water to controlled outlets.

Applications of nitrogen and phosphorus fertilizers generally benefit most crops, except in years when rainfall is below average.

CAPABILITY UNIT IIIe-3 (14)

This unit consists of very deep, well drained and moderately well drained, gently sloping to moderately sloping soils on old terraces and fans. Slopes range from 2 to 9 percent. These soils are in the Hillgate and San Ysidro series and San Ysidro variant. They have a silt loam, clay loam, and loam surface layer and a clay or very gravelly clay subsoil. The substratum consists of sandy clay loam or clay loam. Keefers clay loam, 2 to 9 percent slopes, is included with this unit because its use and management are similar to that of the other soils in the unit.

The soils in this unit are strongly acid to moderately alkaline. Depth to the clay subsoil is 19 to 36 inches. Permeability in the subsoil is slow to very slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Fertility is low to moderate. The available water holding capacity is about 6.5 to 9 inches. Average annual rainfall is 16 to 25 inches, and the growing season is 200 to 275 days.

These soils are suited to shallow-rooted crops. They are used for orchards, vineyards, dryland hay, and pasture. Principal orchard crops are apricots and prunes.

The major restrictions in the use of these soils result from slope and limited soil depth. All tillage and planting should be on the contour or across the slope. In orchards, an annual cover crop should be planted and fertilized. Cover crops help to prevent erosion during the rainy season, and in spring they should be turned under as a green-manure crop to add needed organic matter.

Irrigation must be carefully controlled to avoid saturation of the soil above the very slowly and slowly permeable subsoil. These soils are best suited to sprinkler irrigation systems; however, furrow irrigation is satisfactory where the grade is about 0.5 percent. Waterways and protected outlets should be provided for runoff water.

Fertilizer applications should be based on individual crop needs.

CAPABILITY UNIT IIIe-3 (15)

Azule clay loam, 9 to 15 percent slopes, eroded, is the only soil in this unit. This is a very deep, well-drained, strongly sloping soil on uplands. It has a clay loam surface layer, a gravelly sandy clay subsoil, and a gravelly sandy clay loam substratum.

This soil is medium acid throughout the profile. Roots can penetrate to a depth of 60 inches. Permeability is slow. Runoff is medium, and the hazard of erosion is moderate. Fertility is high. The available water holding capacity is 7 to 8 inches. The average annual rainfall is 16 to 25 inches, and the growing season is 200 to 250 days.

Because irrigation water is not available, this soil is better suited to climatically adapted dryland crops than to crops requiring irrigation. It is used for dryland prunes, grapes, grain hay, and pasture.

To reduce runoff and control erosion, tillage operations should be across the slope or on the contour. A crop rotation that includes plants that produce fine roots helps to improve soil structure, to increase the water infiltration rate, and to maintain the organic-matter content. Returning crop residue or adding organic matter to the soil also helps to maintain the organic-matter content. Where slopes are long, or where runoff water from higher areas crosses this soil, diversions should be provided to convey all excess water to controlled outlets. Fertilizer should be applied according to crop needs, as determined by soil or plant tissue tests.

CAPABILITY UNIT IIIe-5 (15)

Diablo clay, 9 to 15 percent slopes, is the only soil in this unit. This is a moderately deep to deep, well-drained, strongly sloping soil on uplands. It has a clay surface layer and substratum and is underlain by soft calcareous sandstone. This soil is mildly alkaline to moderately alkaline and is calcareous in the substratum. Favorable rooting depth is 26 to 56 inches. Permeability in the subsoil is slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Fertility is high. Available water holding capacity is about 3 to 7 inches. Average annual rainfall is 16 to 20 inches, and the growing season is 250 to 275 days.

Because irrigation water is not available, this soil is better suited to climatically adapted dryland crops than to crops requiring irrigation. It is used for dryland orchards, vineyards, grain hay, pasture, and range. Prunes are the principal orchard crop.

The clay surface layer is difficult to till if the moisture content is not right. To slow runoff water during the rainy season and to decrease the risk of sheet, rill, and gully erosion, tillage and planting should be across the slope. Using a crop rotation that includes plants that provide many roots and plowing under crop residue are needed to increase the water infiltration rate and to improve soil structure. Where slopes are long, or runoff water from higher areas crosses fields, diversions should be provided to convey all excess water to controlled outlets.

Applications of nitrogen and phosphorus fertilizers generally benefit most crops, except in years where rainfall is below average.

CAPABILITY UNIT IIIw-5 (14)

This unit consists of deep, somewhat poorly drained and poorly drained soils on alluvial flood plains. Slopes average less than 2 percent. These soils are in the Campbell, Clear Lake, and Sunnyvale series. They have a silty clay loam, clay, and silty clay surface layer and substratum. The lower part of the substratum of some of these soils consists of clay and muck.

The soils in this unit are neutral to moderately alkaline in the surface layer and substratum. A few of these soils are calcareous in the surface layer and substratum, and slight concentrations of soluble salts are present in places. Rooting depth is restricted by a seasonal water table that is at a depth of 30 to 60 inches. Permeability is slow or moderately slow. The hazard of erosion is none to slight. Runoff is very slow and may be ponded in some areas. A few areas are subject to flooding, and early crops may be destroyed. Fertility is moderate to high. The available water holding capacity is 6 to 13 inches. Average annual rainfall is 16 to 20 inches, and the growing season is 250 to 275 days.

The soils of this unit are suited to the shallow-rooted, climatically adapted crops grown in the area. These soils are used for row crops, limited orchards, and pasture. Principal row crops are beans, garlic, onions, peppers, lettuce, tomatoes, and sugar beets. Pears are the principal orchard crop. Except for pears, orchard crops are not well suited.

These soils are difficult to till except at the proper moisture content. Because of their low position and somewhat poor to poor drainage, these soils tend to collect excess water from higher lying areas. Open drains and tile drains may be used to remove excess water and lower the water table. Irrigation must be controlled to prevent ponding and waterlogging. Sprinkler irrigation systems can best control the quantity of water applied. Furrow irrigation should be carefully managed. To maintain soil fertility and soil structure, a crop rotation that includes a grass-legume crop every 3 to 4 years should be used.

All crops respond readily to fertilizer, but fertilizer needs vary according to the crop grown. Soils that have a high lime content, combined with poor drainage, often cause lime-induced chlorosis. Where chlorosis is a problem, improved drainage and application of iron compounds directly to the crop are beneficial.

CAPABILITY UNIT IIIs-3 (14)

The unit consists of very deep, moderately well drained and well drained, nearly level soils on fans and terraces. Slopes average less than 2 percent. These soils are in the San Ysidro series and the San Ysidro series, acid variant. They have a loam and clay loam surface layer and a clay or very gravelly clay loam subsoil. The substratum consists of sandy clay loam. Keefers clay loam, 0 to 2 percent slopes, is deeper than normal for the soils in this unit but is included with this unit because it has similar use and management problems.

The soils in the unit are strongly acid to moderately alkaline. Depth to the very slowly to slowly permeable subsoil is 18 to 35 inches. Runoff is normally very slow, but some ponding may occur during winter months. The hazard of erosion is none to slight. Fertility is low to moderate. The available water holding capacity is about 5 to 9 inches. Average annual rainfall is 16 to 25 inches, and the growing season is 250 to 275 days.

The soils of this capability unit are suited to shallow-rooted crops such as grain hay and pasture. They are used for orchards, vineyards, dryland grain hay, and pasture. Apricots, prunes, and walnuts are the principal orchard crops grown. Orchard crops are poorly suited because of the slowly and very slowly permeable subsoil.

Irrigation should be carefully controlled to prevent saturation of the surface soil. Where runoff from higher areas crosses fields, diversions should be provided to convey the water to controlled outlets (fig. 5). All crop residue should be returned to the soil to help maintain soil structure and organic-matter content. In orchards, an annual cover crop should be planted and fertilized. Cover crops help to prevent erosion during the rainy season and add needed organic matter. A nitrogen and phosphorus

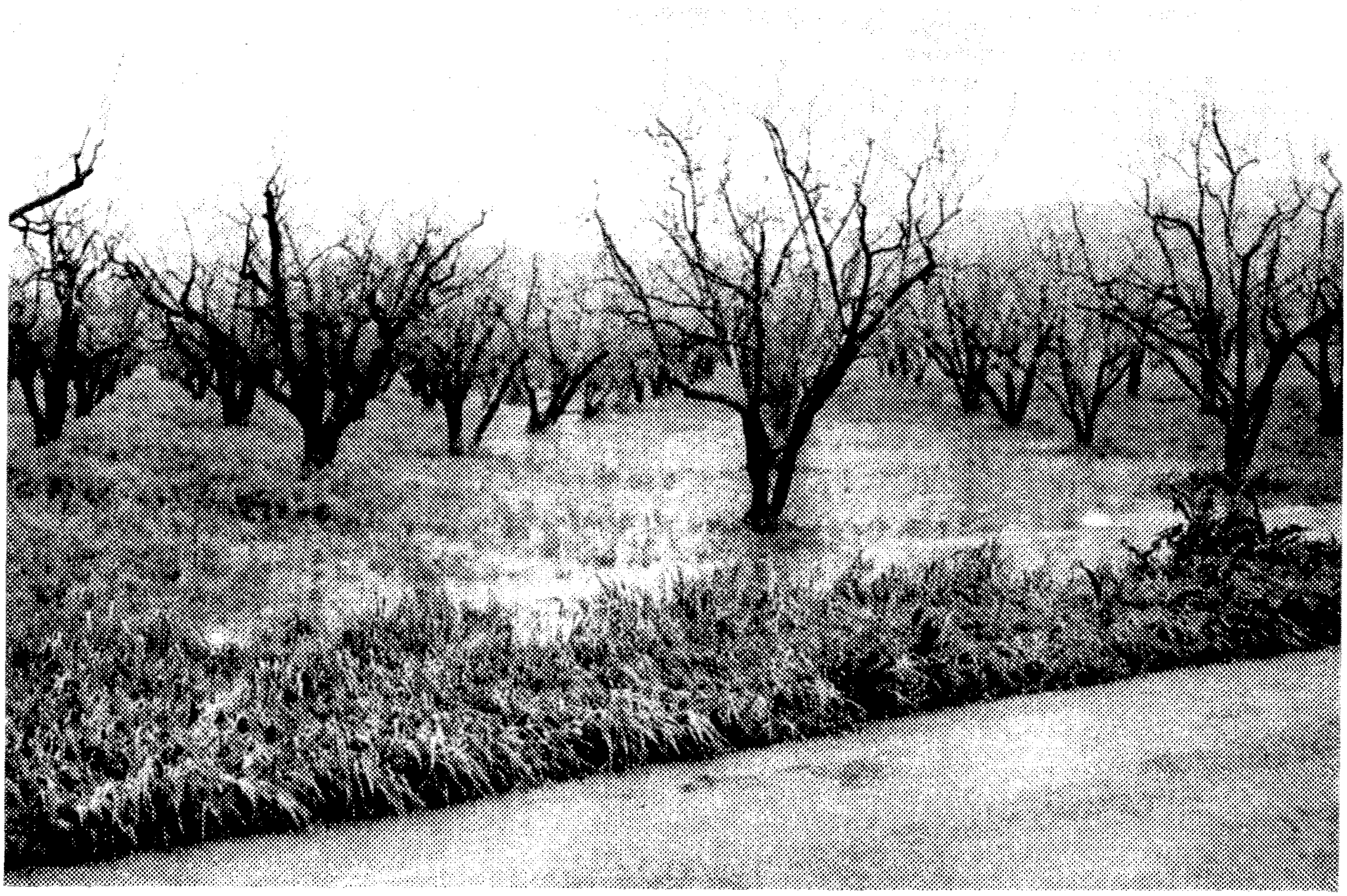

***Figure 5.*—Runoff water from higher areas has accumulated in area of San Ysidro loam, 0 to 2 percent slopes.**

fertilizer generally benefits most crops, but fertilizer needs vary according to the crop grown.

CAPABILITY UNIT IIIc-1 (15)

This unit consists of very deep, well drained and moderately well drained, nearly level soils on alluvial fans. Slopes average less than 2 percent. These soils are in the Esparto, Garretson, and Yolo series. They have a loam surface layer and a silt loam, loam, and light clay loam substratum. Unconformable sand and gravel occur in some areas at a depth of 36 to 60 inches.

The soils in this unit have a medium acid to mildly alkaline surface layer. Favorable rooting depth is more than 60 inches. Permeability is moderate to moderately slow. Runoff is slow to very slow, and the hazard of erosion is none to slight. Fertility is moderate to high. The available water holding capacity is about 7.5 to 12 inches. Average annual rainfall is 15 to 25 inches, and the growing season is 250 to 275 days.

Because irrigation water is not available, the soils in this unit are better suited to climatically adapted dryland crops than to crops requiring irrigation. They are used for dryland grain hay and pasture. On grain-hay land, a green-manure crop should be planted every 3 to 4 years to help maintain organic-matter content and improve soil structure.

All crops grown on these soils respond well to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IVe-1 (4)

Felton silt loam, 15 to 30 percent slopes, is the only soil in this unit. This is a moderately deep, well-drained, moderately steep soil on uplands. It has a silt loam surface layer and a clay loam subsoil. Underlying rock is interbedded shale and sandstone.

Reaction of the surface layer is medium acid. The subsoil is medium acid to strongly acid. Favorable rooting depth is 20 to 36 inches. Runoff is medium, and the hazard of erosion is moderate. Permeability in the subsoil is moderately slow. Fertility is moderate, and the available water holding capacity is about 4 to 7 inches. Average annual rainfall is 40 to 50 inches, and the growing season is 200 to 250 days.

Most areas of this soil have been cleared and used for dryland pasture; a small acreage has been planted to grain hay and Christmas trees. It is suited to Christmas trees or to timber production.

This soil is not well suited to tilled crops, because it has moderately steep slopes and a hazard of erosion. When this soil is cultivated, tillage should be across the slope to control sheet erosion. Crop residue should be returned to the soil to help maintain soil structure and organic-matter content. The soil should have a vegetative cover 3 years out of 5 if used for growing grain hay. Where slopes are long, or runoff water from higher areas crosses fields, diversions should be provided to convey all excess water to controlled outlets. Fire trails should be provided where necessary.

CAPABILITY UNIT IVe-1 (15)

This unit consists of moderately deep to very deep, well-drained, moderately sloping to moderately steep soils on uplands and terraces. Slopes range from 5 to 30 percent. These soils are in the Gilroy, Los Gatos, San Benito, and Pleasanton series. The Gilroy, Los Gatos, and San Benito soils have a gravelly loam and clay loam surface layer and a clay loam or gravelly clay loam subsoil. Their substratum consists of hard, metamorphosed basic igneous and shale bedrock or of gravelly sandy clay loam. Pleasanton gravelly loam, 9 to 15 percent slopes, eroded, differs from the Gilroy, Los Gatos, and San Benito soils. It is a very deep soil that was included in this capability unit because it needs management similar to that of the other soils in this unit.

The soils in this unit are medium acid to moderately alkaline. Favorable rooting depth is 18 to 43 inches to metamorphosed basic igneous rock or shale. Runoff is slow to rapid, and the hazard of erosion is slight to high. Fertility is moderate to high. The available water holding capacity is about 4 to 10 inches. Average annual rainfall is 16 to 40 inches, and the growing season is 200 to 255 days.

These soils are used for dryland grapes, grain hay, pasture, and range. They are best suited to grazing. Because of the slope and hazard of erosion, they should not be cultivated more than 2 years out of 5. Vineyards require either a fertilized and seeded fall cover crop or a continuous cover crop. All tillage should be as nearly on the contour as possible. All crop residue should be returned to the soil to help maintain organic-matter content and improve soil structure.

All crops grown on these soils respond well to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IVe-3 (15)

This unit consists of very deep to moderately deep, well-drained, strongly sloping to moderately steep soils on uplands and terraces. Slopes range from 9 to 30 percent. These soils are in the Azule, Los Osos, and Parrish series. They have a clay loam or gravelly clay loam surface layer and a gravelly clay, gravelly sandy clay, or clay subsoil.

The soils in this unit are medium acid to strongly acid. Depth to bedrock is 24 inches to more than 60 inches. Permeability in the subsoil is slow. Runoff is slow to rapid, and the hazard of erosion is slight to high. Fertility is moderate to high. The available water holding capacity is about 4 to 9 inches. Average annual rainfall is 16 to 30 inches, and the growing season is 200 to 250 days.

These soils are best suited to grazing. They are used for vineyards, grain hay, pasture, and range. Because of the slope and hazard of erosion, they should not be cultivated more than 2 years out of 4.

Vineyards require use of intensive soil conservation practices such as growing a fertilized fall cover crop or a continuous cover crop. All tillage must be on the contour as nearly as possible. All crop residue should be returned to the soil to help maintain organic-matter content and improve soil structure. Where slopes are long, or runoff water crosses fields, diversions should be provided to convey all excess water to controlled outlets.

All crops grown on these soils respond well to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IVe-5 (15)

This unit consists of moderately deep and deep, well-drained, moderately sloping to moderately steep soils on uplands. Slopes range from 9 to 30 percent. These soils are in the Altamont, Climara, Cropley, and Zamora series. They have a clay loam or clay surface layer and subsoil.

The soils in this unit are neutral to moderately alkaline. Favorable rooting depth is 20 to 56 inches and corresponds with depth to bedrock. Permeability is slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Fertility is moderate to high. The available water holding capacity is about 3 to 7 inches. Average annual rainfall is 16 to 30 inches, and the growing season is 200 to 250 days. Because of similar use and management, Zamora and Cropley soils, 2 to 9 percent slopes, severely eroded, are included in this unit. Zamora soils are very deep, are moderately slowly permeable, and have a clay loam subsoil. They were included because they cannot be mapped separately from the Cropley soils. Unlike other soils in this unit, Zamora soils have up to 12 inches of available water holding capacity, surface runoff is slow, and the hazard of erosion is slight on the lesser slopes.

The soils in this unit are suited to grazing. They are used for dryland grain hay, pasture, and range. Because of the slope and hazard of erosion, they should not be cultivated more than 2 years out of 5.

The clay surface layer is difficult to till if the moisture content is not right. All tillage should be as nearly on the contour as possible. On areas used for grain hay, a green-manure crop should be planted every 4 years to help maintain organic-matter content and improve soil structure. All crop residue should be returned to the soil.

All crops grown on these soils respond well to nitrogen fertilizer. Some grasses respond to application of sulfur.

CAPABILITY UNIT IVe-8 (4)

Madonna loam, 15 to 30 percent slopes, is the only soil in this unit. This is a moderately deep, well-drained, moderately steep soil on uplands. It has a loam surface layer and subsoil. The underlying rock is hard sandstone.

The soil is medium acid. Favorable rooting depth is 20 to 28 inches. Permeability is moderate. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Fertility is moderate. The available water holding capacity is 3 to 5 inches. Average annual rainfall is 35 to 50 inches, and the growing season is 200 to 250 days.

The soil in this unit is suited to pasture and range. It is used for grain hay, pasture, and range. A permanent cover, such as grasses, should be grown on these soils 3 years out of 5. All tillage should be on the contour as nearly as possible. All crop residue should be returned to the soil to help maintain organic-matter content and improve soil structure.

CAPABILITY UNIT IVw-4 (14)

Cortina very gravelly loam, 0 to 5 percent slopes, is the only soil in this unit. This is a very deep, somewhat excessively drained, gravelly soil on stream benches. It has a very gravelly loam and very gravelly fine sandy loam surface layer and a very gravelly sandy loam substratum.

This soil is slightly acid in both the surface layer and substratum. Favorable rooting depth is more than 60 inches. Permeability is rapid. Runoff is very slow, and this soil is subject to flooding 3 years out of 10. Fertility is low. The available water holding capacity is 2.5 to 4 inches. Average annual rainfall is 16 to 25 inches, and the growing season is 250 to 275 days.

The soil in this unit is used mainly for pasture. A few areas have been planted to prunes. This soil is suited to some row crops and to orchards. Because of droughtiness and the very gravelly texture, dryland crops do not do well.

Dikes or other water control structures should be provided to protect crops and the soil from damaging overflow. Applications of irrigation water must be light and frequent to prevent loss of water by deep percolation. Water can best be controlled by using a sprinkler irrigation system. Cover crops and green-manure crops help to maintain soil structure and organic-matter content. All crop residue should be returned to the soil.

Crops grown on this soil respond to applications of nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IVw-6 (14)

Willows clay is the only soil in this unit. This is a poorly drained, very deep soil that has slight to moderate soluble salt and alkali concentrations in basins and low positions on the alluvial plains. Slopes average less than 2 percent. This soil has a moderately alkaline clay surface layer and is underlain by a strongly alkaline clay substratum. Favorable rooting depth is restricted by a seasonal water table at a depth of 20 to 40 inches. Permeability is slow. Runoff is very slow, and the hazard of erosion is none to slight. Fertility is low. The available water holding capacity is 6 to 7.5 inches. Average annual rainfall is 16 to 20 inches, and the growing season is 250 to 275 days.

This soil is used for limited row crops and pasture. It is best suited to salt-tolerant pasture. Leached areas that have improved drainage can be used for limited salt-tolerant row crops and grain hay.

Because the basic water intake rate is very slow, irrigation water is difficult to manage. Excess amounts of water are needed to leach salts in order to prevent their accumulation in the upper part of the surface layer. Drains are needed to improve the natural drainage conditions as well as to remove excess water and leached salts during irrigation. Both open and closed drains can be used.

Soil amendments are generally needed on this soil. For example, annually adding approximately 3 tons of 90 percent gypsum per acre lowers the alkali content to a level the crops can tolerate. Generally, the upper 12 inches of the surface layer of this soil can be reclaimed and maintained. Substratum reclamation, however, has proven difficult. The surface layer should be leached so as to obtain a good emergence of seed for adapted crops. Crop residue or other organic matter should be returned to the soil to improve the structure and tilth.

CAPABILITY UNIT IVs-9 (14)

Maxwell clay, 0 to 5 percent slopes, is the only soil in this unit. This is a very deep, moderately well drained, nearly level to gently sloping soil on fans. It has a neutral to mildly alkaline clay surface layer that is underlain by a moderately alkaline clay and gravelly clay loam substratum.

This soil has a favorable rooting depth of more than 60 inches. Permeability is slow. Runoff is very slow to slow, and the hazard of erosion is none to slight. Fertility is low because of an unfavorable calcium-magnesium ratio. The available water holding capacity is 8 to 10 inches. Average annual rainfall is 16 to 20 inches, and the growing season is 260 to 275 days.

This soil is used for limited orchards, dryland grain hay, and pasture. The only orchard crop grown is prunes.

Because of low fertility, this soil is better suited to pasture than to most other uses.

Crop residue should be returned to the soil to improve soil structure. The clay texture of the surface layer makes tillage difficult unless the moisture content is right. Excess water from higher lying areas may collect on the surface and should be diverted into suitable outlets. Irrigation must be controlled to prevent ponding and waterlogging. Sprinkler irrigation systems can best control the quantity of water applied.

Use of fertilizer has not proven economical.

CAPABILITY UNIT VIe-1 (4)

Felton silt loam, 30 to 50 percent slopes, is the only soil in this unit. This is a moderately deep to deep, well-drained, steep soil on uplands. It has a silt loam surface layer and a clay loam subsoil. Underlying rock is interbedded shale and sandstone.

This soil is medium acid in the surface layer and medium acid to strongly acid in the subsoil. Favorable rooting depth is 35 to 59 inches. Permeability in the subsoil is moderately slow. Runoff is rapid, and the hazard of erosion is high. The available water holding capacity ranges from 5 to 10 inches. Fertility is moderate. Average annual rainfall is 40 to 50 inches, and the growing season is 200 to 250 days.

This soil is used for timber production and range. It is best suited to timber production, Christmas tree production, and grazing. This soil should not be used for cultivated crops.

The soil in this unit should have a permanent cover because of the steep slopes and high hazard of erosion. To keep sheet and gully erosion to a minimum, the gradient of logging roads should not exceed 12 percent. Adequate ditches and culverts should be provided on main roads for control of runoff water. Placing slash on landings and skid trails after logging helps to prevent gullies. Slash should be kept out of streams to maintain accessibility to fish and other wildlife and to prevent flooding. Fire trails should be provided where needed.

CAPABILITY UNIT VIe-1 (15)

This unit consists of moderately deep to deep, well-drained, moderately steep to steep soils on uplands. Slopes range from 15 to 50 percent. These soils are in the Gilroy, San Andreas, San Benito, and Santa Lucia series. They have a fine sandy loam, clay loam, and gravelly or shaly loam surface layer. Texture of the subsoil is sandy loam, clay loam, gravelly clay loam, or very shaly clay loam. The substratum is hard, shattered sandstone, shale, or basic igneous rock.

The soils in this unit are medium acid to moderately alkaline. Permeability is moderately slow to moderately rapid. Depth to bedrock is 20 to 50 inches. Runoff is rapid, and the hazard of erosion is high. Fertility is moderate to high. The available water holding capacity is about 2 to 10 inches. Average annual rainfall is 16 to 40 inches, and the growing season is 200 to 250 days.

These soils are used for grapes and range. Because of the hazard of erosion, they are best suited to grazing.

The soils in this unit should not be cultivated, except to prepare a seedbed to plant better forage grasses and legumes. Proper grazing management is needed to obtain good yields of forage and to control sheet and gully erosion. Fire trails should be provided where needed. Nitrogen, phosphorus, and sulfur fertilizers, applied in adequate amounts before the first rain, increase early production of forage.

CAPABILITY UNIT VIe-3 (15)

This unit consists of moderately deep to deep, well-drained, strongly sloping to steep soils on uplands and terraces. These soils are in the Hillgate, Los Osos, and Parrish series. They have a silt loam, clay loam, or gravelly clay loam surface layer and a gravelly clay or clay subsoil. They overlie old terrace sediments or metamorphosed shale. The soils on terraces have slopes that range from 9 to 30 percent, and the soils on uplands have slopes that range from 30 to 50 percent.

The soils in this unit are slightly acid to strongly acid. Rooting depth generally is 24 inches to more than 60 inches, but in places it is as shallow as 10 inches for root-sensitive crops because of the slowly permeable clay subsoil. Permeability in the subsoil is slow to very slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Fertility rate is high to low, and the available water holding capacity is about 4 to 8 inches. Average annual rainfall is 16 to 30 inches, and the growing season is 200 to 275 days.

These soils are used for range. Because they are subject to sheet and gully erosion, they are better suited to grazing than to most other uses.

The soils in this unit should not be cultivated, except to prepare a seedbed for planting better forage grasses and legumes. Proper grazing management is needed to control erosion and to obtain good yields of forage. Fire trails should be provided where needed. Nitrogen, phosphorus, and sulfur fertilizers, applied in adequate amounts before the first rain, increase early yields of forage.

CAPABILITY UNIT VIe-5 (15)

This unit consists of moderately deep and deep, well-drained, moderately steep to steep soils on uplands. Slopes range from 15 to 50 percent. These soils are in the Altamont, Climara, and Diablo series. They have a clay and stony clay surface layer and a clay substratum. The parent material is shale, sandstone, and basic igneous rock.

The soils in this unit are neutral to moderately alkaline. The moderately alkaline soils in places are calcareous in the surface layer and in the substratum. Favorable rooting depth is 20 to 56 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Fertility is moderate to high, and the available water holding capacity is about 3 to 7 inches. Average annual rainfall is 16 to 25 inches, and the growing season is 200 to 275 days.

These soils are used for range. They are well suited to grazing, and forage production is high.

The soils in this unit should not be cultivated, except to prepare a seedbed for planting better forage grasses and legumes. Proper grazing management is needed to control erosion and to obtain good production of forage. Fire trails should be provided where needed. Nitrogen, phosphorus, and sulfur fertilizers, applied in adequate amounts before the first fall rain, increase early production of forage.

CAPABILITY UNIT VIe-7 (15)

This unit consists of shallow to moderately deep, well-drained, moderately sloping to moderately steep soils on uplands. Slopes range from 5 to 30 percent. These soils are in the Gaviota and Vallecitos series. They have a loam surface layer and a gravelly loam and clay subsoil that is underlain by hard sandstone and shale rock. The surface is 2 to 10 percent rock outcrops.

The soils in this unit are slightly acid to medium acid. Favorable rooting depth is 10 to 30 inches to bedrock. Permeability in the subsoil is slow to moderate. Runoff is slow to rapid, and the hazard of erosion is slight to high. Fertility is low to moderate. The available water holding capacity is 2 to 6 inches. Average annual rainfall is from 15 to 30 inches, and the growing season is 200 to 250 days.

Because of rock outcrops on the surface, the soils in this unit are not suited to cultivation but are used for range. Limited cultivation, such as the reseeding needed to establish grasses or legumes, can be done to increase forage and to control erosion. Proper grazing management is needed to obtain good production of forage.

Nitrogen, phosphorus, and sulfur fertilizers, applied in adequate amounts before the first rains in fall, increase early yields of forage.

CAPABILITY UNIT VIe-8 (4)

Madonna loam, 30 to 50 percent slopes, is the only soil in this unit. This is a moderately deep, well-drained, steep soil on uplands. The surface layer and subsoil are loam and are underlain by coarse-grained hard sandstone.

This soil is medium acid. Favorable rooting depth is 20 to 28 inches. Runoff is rapid, and the hazard of erosion is high. Permeability is moderate. Fertility is moderate, and the available water holding capacity is 3 to 5 inches. Average annual rainfall is 35 to 50 inches, and the growing season is 200 to 250 days.

This soil is used for range and watershed. It is better suited to pasture and range than to most other uses.

Because of the steep slopes and high hazard of erosion, this soil should not be cultivated. All cultivation operations, where used, should be across the slope. Where this soil is planted to dryland orchards, intensive conservation practices are needed to prevent sheet and gully erosion. A fall cover crop should be seeded and fertilized, or a permanent cover crop should be grown. All crop residue should be returned to the soil to help maintain organic-matter content and soil structure. Fire trails should be constructed where needed.

CAPABILITY UNIT VIe-8 (15)

This unit consists of very shallow to shallow, well-drained and somewhat excessively drained, moderately sloping to moderately steep soils on uplands. The soils are in the Gaviota series. They are loam and gravelly loam that are about 6 to 20 inches deep to hard sandstone.

The soils in this unit are slightly acid. Slopes range from 5 to 30 percent. Permeability in the subsoil is moderate. Runoff is slow to rapid, and the hazard of erosion is slight to high. Fertility is low. The available water holding capacity is about 1 to 3 inches. Average annual rainfall is 15 to 30 inches, and the growing season is 200 to 250 days.

These soils are used for pasture and range. Because of the shallow depth to hard sandstone and the hazard of erosion, these soils are better suited to grazing than to most other uses. They should not be cultivated, except to prepare a seedbed for improved grasses and legumes. Proper grazing management is needed to obtain good production of forage and to control sheet and gully erosion. Applications of nitrogen, phosphorus, and sulfur fertilizers increase forage production.

CAPABILITY UNIT VIw-4 (15)

Cortina very gravelly loam, 0 to 5 percent slopes, is the only soil in this unit. This is a very deep, somewhat excessively drained, nearly level to gently sloping soil on benches along drainageways. It has a very gravelly loam surface layer and a very gravelly sandy loam substratum.

This soil is slightly acid throughout the profile. Roots can penetrate to a depth of more than 60 inches. Permeability is rapid. Runoff is very slow, and the hazard of erosion is none to slight. This soil is subject to flooding about 3 years out of 10. Fertility is low, and the available water holding capacity is 2.5 to 4 inches. Average annual rainfall is 16 to 25 inches, and the growing season is 250 to 275 days.

This soil is used for dryland pasture, wildlife habitat, and recreation. Because irrigation water is not available, this soil is better suited to pasture, range, wildlife habitat, and recreation than to most other uses. The low available water holding capacity makes this soil unsuitable for economical production of dryland crops. Dikes or other water diversion structures should be provided to protect this soil from damaging overflow. Grazing must be carefully managed to maintain adequate forage production. Fertilizing and reseeding with adapted annuals improve forage quality and production.

CAPABILITY UNIT VIIe-1 (4)

This unit consists of moderately deep to deep, well-drained, very steep soils on uplands. Slopes range between 50 and 75 percent. These soils are in the Ben Lomond and Felton series. They have a silt loam or fine sandy loam surface layer and a very fine sandy loam or clay loam subsoil. The substratum is soft shales and sandstone.

The surface layer is medium acid, the subsoil is medium to strongly acid, and the substratum is strongly acid. Favorable rooting depth is from 33 to 60 inches. Runoff is very rapid, and the hazard of erosion is very high. Fertility is moderate. The available water holding capacity is about 5 to 10 inches. Permeability in the subsoil is moderately rapid or moderately slow. Average annual rainfall is 35 to 50 inches, and the growing season is 200 to 250 days.

The soils in this unit are used for timber production, wildlife, recreation, and watershed. They are better suited to forestry, wildlife, recreation, and watershed than to most other uses.

Because of very steep slopes and a very high hazard of erosion, these soils have severe limitations for equipment use and require intensive erosion control practices. When these soils are logged, roads and trails should be located so that gradients are kept small and adequate surface drainage is provided. Outsloping of temporary roads is recommended. For regeneration, a source of seed for young timber stands is about 80 trees per 10 acres. Seed trees should be 18 inches or more in diameter at breast height. Slash disposal should be by lapping and scattering, except where the fire hazard necessitates burning small concentrations of slash. Erosion is reduced by using logging slash on skid trails; however, slash should be kept out of streams to maintain accessibility for fish and other wildlife and to prevent flooding. Fire trails should be provided where needed.

CAPABILITY UNIT VIIe-1 (15)

This unit consists of moderately deep to deep, well-drained, steep to very steep soils on uplands and terraces. Slopes range from 30 to 75 percent. These soils are in the Azule, Gilroy, Hillgate, Los Gatos, Los Osos, Parrish, San Andreas, San Benito, and Santa Lucia series. Also included in this unit is Terrace escarpments. The soils in this unit have a fine sandy loam, silt loam, shaly loam, gravelly loam, gravelly clay loam, or clay loam surface layer. Texture of the subsoil is sandy loam to clay and in places is gravelly or very shaly. These soils overlie old, soft sediments, sandstone, shale, and basic igneous rocks.

The soils in the unit are strongly acid to moderately alkaline. Favorable rooting depth generally is 20 inches to more than 60 inches. Permeability in the subsoil is moderately rapid to very slow. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. Fertility is low to high. The available water holding capacity is about 2 to 10 inches. Average annual rainfall is 16 to 40 inches, and the growing season is 200 to 275 days.

These soils are used for range, wildlife, and watershed.

Because of steep to very steep slopes and a high or very high hazard of erosion, these soils should have a permanent cover. Good grazing management maintains forage production and protects these soils from sheet and gully erosion. Seeding and fertilizing are too difficult and response is too poor to justify the expense, except for erosion and sedimentation control. Fire trails should be provided where needed.

CAPABILITY UNIT VIIe-5 (15)

Altamont clay, 50 to 75 percent slopes, eroded, is the only soil in this unit. This is a moderately deep, well-drained, very steep soil on uplands. Also included in this unit is Landslides. This Altamont soil has a clay surface layer and substratum. The parent material is fractured shale.

The soil in this unit is neutral to moderately alkaline. The substratum is calcareous in places. Permeability is slow. Favorable rooting depth is 25 to 35 inches or more. Runoff is very rapid, and the hazard of erosion is very high. Fertility is high, and the available water holding capacity is about 3.5 to 4.5 inches. Average annual rainfall is 15 to 30 inches, and the growing season is from 200 to 250 days.

This soil is used for range, wildlife, watershed, and recreation. It produces a large amount of forage and is better suited to grazing than to most other uses.

The soil in this unit is not suited to cultivation, because of slope and the hazard of erosion. Good grazing management maintains forage production and protects the soil from sheet erosion. Fire trails should be provided where needed.

CAPABILITY UNIT VIIe-7 (15)

This unit consists of shallow, well-drained and somewhat excessively drained, very steep soils on uplands. These soils are in the Inks, Maymen, and Vallecitos series. They have a fine sandy loam, loam, or gravelly clay loam surface layer and a fine sandy loam, gravelly clay loam, or clay subsoil that is underlain by hard basic igneous rock, sandstone, or shale. About 2 to 10 percent of the surface is covered by rock outcroppings.

The soils in this unit are slightly acid to strongly acid. Favorable rooting depth is 11 to 24 inches. Runoff is very rapid, and the hazard of erosion is very high. Permeability is moderately rapid to slow. Fertility is low to moderate. The available water holding capacity is about 1 to 5 inches. Average annual rainfall is 16 to 50 inches, and the growing season is 200 to 250 days.

These soils are used for limited range, wildlife habitat, recreation, and watershed. They are better suited to these uses than to most other uses because of slope, shallow soil depth, and rockiness. They provide limited forage for livestock and wildlife and cover for erosion control. Reseeding generally is too difficult and expensive to be justified as a way of controlling erosion and sedimentation. Fire trails should be provided where needed.

CAPABILITY UNIT VIIe-8 (4)

Madonna loam, 50 to 75 percent slopes, is the only soil in this unit. This is a moderately deep, well-drained, very steep soil on uplands. It has a surface layer and subsoil of loam that is underlain by hard, coarse-grained sandstone.

This soil is medium acid. Favorable rooting depth is 20 to 28 inches. Runoff is very rapid, and the hazard of erosion is very high. Permeability is moderate. Fertility is moderate. The available water holding capacity is about 3 to 5 inches. Average annual rainfall is 35 to 50 inches, and the growing season is 200 to 250 days.

This soil is used for range, recreation, and watershed. It is better suited to these than to most other uses because of the very steep slopes and a very high hazard of erosion. Good grazing management maintains forage production and protects this soil from sheet and gully erosion. Areas that have a dense brush cover are best maintained as protected watershed and browse areas for wildlife. Fire trails should be provided where needed.

CAPABILITY UNIT VIIe-8 (15)

This unit consists of shallow and moderately deep, somewhat excessively drained and well-drained, steep to very steep soils on uplands. Slopes are 30 to 75 percent. These soils are in the Gaviota, Los Gatos, and Maymen series. They are fine sandy loam to gravelly loam about 6 to 20 inches deep to hard sandstone.

The soils in this unit are slightly acid to strongly acid. Permeability is moderately rapid to moderately slow. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. Fertility is low to moderate. Available water holding capacity is about 1 to 8 inches. Average annual rainfall is 15 to 50 inches, and the growing season is 200 to 250 days.

These soils are used for range, watershed, wildlife habitat, and recreation. Because of the shallow depth to hard sandstone, the steep to very steep slopes, and a high to very high hazard of erosion, these soils should be kept in a permanent cover. Good grazing management maintains forage production and protects the soils from erosion. Seeding and fertilizing are not practicable on these soils.

CAPABILITY UNIT VIIe-9 (15)

This unit consists of shallow, somewhat excessively drained, moderately steep to steep soils on uplands. These soils are in the Montara and Henneke series. They have a clay loam and gravelly clay loam surface layer that is underlain by serpentine rock. About 5 to 10 percent of the surface is covered by stones and rock outcroppings.

These soils are moderately alkaline. Favorable rooting depth is 10 to 18 inches. Runoff is medium to very rapid, and the hazard of erosion is moderate to very high. Permeability is moderately slow to slow. Fertility is low and very low. The available water holding capacity is about 1 to 3 inches. Average annual rainfall is 16 to 25 inches, and the growing season is 200 to 275 days.

The soils in this unit are used for limited range, wildlife, recreation, and watershed. They are better suited to these uses than to most other uses because of slope, shallow soil depth, low fertility, and rockiness. Forage production is low. Fertility is low because of an unfavorable calcium-magnesium ratio. Reseeding is too difficult and expensive to justify, except for erosion and sedimentation control. Fire trails should be provided where needed.

CAPABILITY UNIT VIIIw-4 (14, 15)

Only Riverwash is in this unit. It consists of coarse or very coarse material in stream channels. This land type is not suited to the commercial production of plants. It should be managed for wildlife habitat and for recreation.

CAPABILITY UNIT VIIIs-1 (15)

Only Rock land is in this unit. It consists of rock outcrops and very shallow soils having slopes of 50 to 75 percent. Runoff is very rapid, and the hazard of erosion is very high. Available water holding capacity is less than 2 inches. The present chamise brush cover provides valuable protection against sediments washing into streams. This land type is better suited to wildlife habitat, recreation, and watershed than to most other uses.

Storie Index Rating[2]

In the "Guide to Mapping Units," the soils of the Eastern Santa Clara Area are listed in alphabetic order and are rated according to the Stories index (*9*). This index expresses numerically the relative degree of suitability, or value, of a soil for general intensive farming. The rating is based on soil characteristics only. It does not take into account other factors, such as availability of water for irrigation, climate, and distance from markets, which might determine the desirability of growing specific crops in a given locality. For these reasons the index, in itself, cannot be considered an index for land valuation.

Four factors that represent the inherent characteristics and qualities of the soil are considered in the index rating. Each factor is rated or evaluated separately in terms of percentage of the ideal, or 100 percent. The factors are:

Factor A, *Profile characteristics.*—Factor A expresses relative suitability of a profile for the growth of plant roots. Soils that have deep, permeable profiles are rated 100 percent. Those that have a dense clay layer or a hardpan or are shallow over bedrock are rated less than 100 percent. The rating depends upon the extent to which root penetration is limited.

Factor B, *Texture of the surface soil.*—Factor B is rated according to the texture of the surface soil, which affects the ease of tillage and the capacity of the soil to hold water. The moderately coarse and medium textures—fine sandy loam, loam, and silt loam—are the most desirable and are rated as 100 percent. The coarser and finer textures, such as sand and clay, are rated less than 100 percent.

Factor C, *Slopes.*—Factor C is particularly important if the soil is irrigated. The amount of water that runs off a soil and its susceptibility to erosion are influenced by the slope of the soil. Smooth, nearly level or very gently sloping soils are rated as 100 percent. The rating decreases as the slope increases.

Factor X, *Other conditions.*—Factor X is used to evaluate any limitations to use of the soil, such as poor drainage or high water table, erosion, salts or alkali, low fertility, acidity, or unfavorable microrelief. If more than one limitation exists, the values of each are multipled together to get the X factor.

The index rating of a soil is obtained by multiplying the four factors, A, B, C, and X; thus, any one factor may dominate or control the final rating. For example, a soil may have an excellent profile justifying a rating of 100 percent for factor A, excellent texture of the surface soil justifying 100 percent for factor B, a smooth, nearly level surface justifying a rating of 100 percent for factor C, but a high accumulation of salts or alkali that would give a rating of 20 percent for factor X. Multiplying these four ratings gives an index rating of 20 for this soil. The high accumulation of salts or alkali dominates, makes the soil unproductive for crops, and justifies the low index rating of 20.

Soils are placed in grades according to their suitability for farm crops as shown by their Storie index ratings. The six grades and their range in index ratings are—

	Index rating
Grade 1	80 to 100
Grade 2	60 to 80
Grade 3	40 to 60
Grade 4	20 to 40
Grade 5	10 to 20
Grade 6	Less than 10

Soils of grade 1 have few or no limitations that restrict their use for crops. Soils of grade 2 are suitable for most crops, but they have minor limitations that narrow the choice of crops and have few special management needs. Grade 3 soils are suited to a few crops or to special crops and require special management. Grade 4 soils are severely limited for crops. If used for crops, they require careful management. Grade 5 soils are not suited to cultivated crops but can be used for pasture and range. Grade 6 consists of soils and land types that generally are not suited for farming.

Estimated Yields and Soil Management Practices

This section presents yields of the principal crops grown in the survey area and some of the management practices used to obtain these yields. Yields are listed in table 2 for apricots, grapes, pears, prunes, sugar beets, tomatoes, and walnuts. These estimates are based on observations made by the soil scientists who surveyed the area, on information furnished by farmers, on data from the Soil Conservation Service, and on crop data from Federal and county census records. Detailed information was not available for crops on some soils. If little or no information was available about the yield on a particular soil, estimates were made by comparing that soil with a similar soil. Information on yields on soils used for range is contained in the section "Range."

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[2] GORDON L. HUNTINGTON, specialist in soils, University of California, Davis, California, helped to prepare this subsection.

The estimated yields given in table 2 are for the principal irrigated crops grown in the survey area under optimum management. This is a level of management, based on experience, field trials, and research findings, from which highest returns can be expected at the present time.

The information on yields and management practices provided in this part of the soil survey will be most useful immediately upon release of this survey, because new developments in crops, plant breeding, control of insects and diseases, use of fertilizer, tillage, irrigation, and drainage may make obsolete much of the information on management. The latest information can be obtained from State and Federal publications or agricultural agencies.

Several important limitations should be kept in mind when using the yield estimates in table 2. First, the figures are estimates or predictions. Second, the figures are averages that may be expected over a period of years. Third, there are considerable variations in some soils, such as variations resulting from the content of salts and alkali, and these were considered in making the estimates.

Management commonly practiced for most crops grown in the Eastern Santa Clara Area includes proper seedbed preparation and control of insects and weeds. Under an optimum level of management, the best adapted and most desirable varieties of crops are grown and planting, har-

TABLE 2.—*Estimated acre yields for principal irrigated crops*

[No estimates are given for soils on which a particular crop is not grown. Dashes indicate that the soil is not suited to that particular crop]

Soil name	Apricots (fresh)	Grapes, wine (fresh)	Pears (fresh)	Prunes (fresh)	Sugar beets	Tomatoes (fresh)	Walnuts
	Tons	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Pounds*
Arbuckle gravelly loam, 0 to 2 percent slopes	6	------	------	6	------	20	1, 000
Campbell silty clay loam	8	------	25	10	35	35	2, 000
Campbell silty clay loam, clay substratum	------	------	------	------	20	30	------
Campbell silty clay	8	------	25	8	30	30	1, 500
Campbell silty clay, muck substratum	------	------	------	------	20	30	------
Clear Lake clay	------	------	15	------	20	25	------
Clear Lake clay, drained	5	------	15	8	30	30	------
Clear Lake clay, saline	------	------	------	------	15	20	------
Cortina very gravelly loam, 0 to 5 percent slopes	------	------	------	6	------	------	------
Cropley clay, 0 to 2 percent slopes	5	------	15	8	30	25	1, 500
Cropley clay, 2 to 9 percent slopes	5	------	15	8	30	25	1, 500
Garretson loam, gravel substratum, 0 to 2 percent slopes	8	5	------	8	------	35	1, 500
Garretson gravelly loam, 0 to 5 percent slopes	6	5	------	6	------	30	1, 500
Hillgate silt loam, 2 to 9 percent slopes	4	3	------	3	------	------	------
Keefers clay loam, 0 to 2 percent slopes	5	4	------	6	------	20	1, 000
Keefers clay loam, 2 to 9 percent slopes, eroded	5	4	------	6	------	20	1, 000
Los Gatos gravelly loam, 15 to 30 percent slopes, eroded	------	3	------	------	------	------	------
Los Robles clay loam, 0 to 2 percent slopes	8	5	------	8	------	30	2, 000
Los Robles clay loam, 2 to 9 percent slopes	8	5	------	8	------	30	2, 000
Maxwell clay, 0 to 5 percent slopes	------	------	------	4	------	------	------
Pacheco fine sandy loam	------	------	10	------	20	25	------
Pacheco silt loam, drained	------	------	------	10	30	35	2, 000
Pacheco clay loam	------	------	10	------	20	25	------
Pacheco clay loam, gravelly substratum	------	------	------	8	------	35	------
Pleasanton loam, 0 to 2 percent slopes	7	5	------	8	------	25	1, 500
Pleasanton loam, 2 to 9 percent slopes	7	5	------	8	------	25	1, 500
Pleasanton gravelly loam, 0 to 2 percent slopes	6	5	------	6	------	20	1, 000
Pleasanton gravelly loam, 2 to 9 percent slopes	6	5	------	6	------	20	1, 000
Rincon clay loam, 0 to 2 percent slopes	7	5	------	6	------	25	1, 500
Rincon clay loam, 2 to 9 percent slopes, eroded	7	5	------	8	------	25	1, 500
San Andreas fine sandy loam, 15 to 30 percent slopes, eroded	------	4	------	------	------	------	------
San Ysidro loam, 0 to 2 percent slopes	4	3	------	3	------	15	------
San Ysidro loam, acid variant, 0 to 2 percent slopes	4	3	------	3	------	15	------
San Ysidro loam, acid variant, 2 to 9 percent slopes	4	3	------	3	------	15	------
Sunnyvale silty clay	------	------	------	------	------	15	------
Sunnyvale silty clay, drained	------	------	15	6	20	20	------
Willows clay	------	------	------	------	------	15	------
Yolo loam, 0 to 2 percent slopes	8	------	25	10	35	35	2, 000
Yolo loam, 2 to 5 percent slopes	8	------	25	10	35	35	2, 000
Yolo silty clay loam, 0 to 2 percent slopes	8	5	25	10	35	35	2, 000
Yolo silty clay loam, 2 to 9 percent slopes	8	5	25	10	35	35	2, 000
Zamora loam, 0 to 2 percent slopes	8	5	------	10	30	35	2, 000
Zamora loam, 2 to 9 percent slopes	8	5	------	10	30	35	2, 000
Zamora clay loam, 0 to 2 percent slopes	8	5	------	10	30	35	2, 000
Zamora clay loam, 2 to 9 percent slopes	8	5	------	10	30	35	2, 000

vesting, pruning, tillage, irrigation, and other management practices are performed at the proper time. Management by capability units is discussed in the section "Capability Groups of Soils."

The following paragraphs discuss the cropping sequence, rates of planting and fertilization, and amounts of irrigation water assumed when the yields for the crops specified in table 2 were estimated.

Apricots (*fresh*).—Apricots use 40 pounds of nitrogen and 40 pounds of phosphorus per acre annually. For a cover crop on sloping soils, 30 pounds of barley seed and 20 pounds of purple vetch or 80 pounds of horsebeans is planted. From 27 to 34 acre-inches of irrigation water is used, applied in two to four applications before harvest and one or two applications after harvest.

Grapes, wine (*fresh*).—From 40 to 60 pounds of nitrogen per acre is used annually. A cover crop of adapted bromegrass is drilled between the rows at a rate of 8 pounds per acre to reduce sheet and gully erosion. From 6 to 12 acre-inches of irrigation water is applied in two applications during the year. Prunings from grapevines are shredded and disked into the soil in alternate rows.

Pears (*fresh*).—From 100 to 175 pounds of nitrogen per acre is used, depending on vigor of the trees. Zinc points are driven into trees where necessary. For a cover crop on sloping soils, 30 pounds of barley seed and 20 pounds of horsebeans are planted. From 27 to 34 acre-inches of irrigation water is applied in about four or five annual applications.

Prunes (*fresh*).—From 60 to 100 pounds of nitrogen per acre is used annually for prunes; on some soils, as much as 60 pounds of potassium is used. For winter cover, 20 pounds of purple vetch and 30 to 60 pounds of barley or 80 pounds of horsebeans is planted on the sloping soils. From 24 to 36 acre-inches of irrigation water is applied annually. Irrigation water is applied three or four times before harvest and one or two times after harvest to help establish the cover crop.

Sugar beets.—A typical cropping sequence consists of sugar beets for 1 year, a truck crop for 1 to 3 years, and a winter green-manure crop. Three years of alfalfa can be substituted for the winter green-manure crop. Sometimes corn is grown for silage for 1 year. From 120 to 150 pounds of nitrogen per acre per year is used. From 24 to 36 acre-inches of irrigation water is applied.

Tomatoes (*fresh*).—A typical cropping sequence consists of tomatoes grown for 2 years and sugar beets or a truck crop for 1 year. A winter green-manure crop or alfalfa grown for 3 years can be substituted for the sugar beets. Tomatoes are fertilized according to the individual needs of the soil and plants, as indicated by chemical analyses. In the Eastern Santa Clara Area, tomatoes generally use 40 to 80 pounds of nitrogen and 40 pounds of phosphorus per acre per year. Potassium is also used on some soils. From 24 to 36 acre-inches of irrigation water is used annually.

Walnuts.—From 100 pounds to 150 pounds of nitrogen per acre annually is applied in two separate applications. For a cover crop on sloping soils, 30 pounds of barley seed and 20 pounds of purple vetch seed or 80 pounds of horsebeans is planted. From 30 to 40 acre-inches of irrigation water, in about three or four applications, is used annually. At least one application follows harvest.

Range[3]

Approximately 391,390 acres in the survey area is used for range. Soils in the Gaviota, Los Gatos, Vallecitos, and Gilroy series are the major soils used for range. They are on the mountains that parallel the valley on the east and west sides. The Diablo, Altamont, Azule, and Los Osos soils produce large amounts of forage. These soils are in a narrow belt just above the valley on the east.

A large acreage of Gaviota gravelly loam and Rock land that produces small amounts of forage is along the county line on the east, extending from Alameda County on the north nearly to the Merced County line on the south. This area is very steep and is generally covered with brush.

Range sites

Range sites are kinds of soil that produce significantly different kinds or amounts of vegetation. Each site has a different potential for production of forage, and each presents different management problems. Most of the important range forage plants in the Eastern Santa Clara Area are introduced. The original forage plants are mostly cool-weather annuals. The annuals take full advantage of the soil moisture while it is available, produce seed, and mature by the time the moisture is gone. They furnish highly nutritious feed in spring, when they are green and growing, but after maturity their nutritional value is low.

The forage-producing plants of the area are grouped into three classes: desirable, less desirable, and undesirable. Livestock graze selectively. They seek out the more palatable and nutritious plants. If grazing is not carefully regulated, the better, more desirable plants are weakened or eliminated. Less desirable plants then increase. If grazing is continued, even the second-choice plants are thinned out or eliminated and undesirable, unpalatable plants take their place or the soil is left bare.

The soils in the Eastern Santa Clara Area have been grouped into seven range sites. The following range site descriptions include (1) a brief description of the soils as a group that make up the site, (2) a listing of the important, desirable, less desirable, and undesirable forage plants, (3) the acreage and general location of the sites in the survey area, and (4) the estimated production potential.

CLAYEY SITE

This site lies in a narrow belt on the lower foothills along the east side of the valley. Elevation ranges from 400 to 2,000 feet. The average annual rainfall ranges from 16 to 25 inches. This site is the highest forage-producing site in the survey area, and it occupies about 8,500 acres. The major acreage consists of soils that have slopes of 30 to 50 percent. There are only small acreages of soils that have slopes of more than 50 percent and about 2,000 acres that have slopes of less than 30 percent.

The soils in this site are in the Altamont, Climara, Diablo, and San Benito series. The land type Landslides is also in this site. These soils are well-drained clays and clay loams that are more than 20 inches deep to calcareous sandstone, shale, or metamorphosed basic igneous rock. The surface layer is neutral to moderately alkaline. The moderately alkaline soils have a calcareous substratum.

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[3] This section was prepared by ROCHE D. BUSH, range conservationist, Soil Conservation Service, Berkeley, California.

These soils have moderately slow to slow permeability, and available water holding capacity is 3 to 10 inches. Fertility is moderate or high. There are some rock outcroppings, particularly in the Climara soils. Landslips are frequent in these soils.

This site mainly has a cover of open grass. Individual oaks and clusters of oaks are on some north-facing slopes (fig. 6). When the site is producing at its potential, approximately 70 percent of the herbage is a mixture of wild oats, soft chess, and filaree, and large amounts of burclover. Other desirable plants, including remnant perennial grasses, are also present. Approximately 20 percent is ripgut brome, annual fescues, annual lupines, wild barley, and other less desirable plants. The rest consists of silver hairgrass, tarweed, vinegarweed, turkeymullein, thistle, and mustard or other undesirable plants.

The soils in this site, except AcG2, LoF, and SbF3, are well suited to seeding with Hardinggrass and adapted annual grasses and legumes. Forage plants respond well to applications of nitrogen, phosphorus, and sulfur.

Brush and trees are not a problem on this site. The safe operation of equipment limits range improvement practices on this site to soils that have slopes of less than 50 percent.

Total annual production of air-dry forage on this site ranges from 4,000 pounds per acre in favorable years to 1,800 pounds per acre in unfavorable years.

FINE LOAMY SITE

This site is in the same general area as the Clayey range site, in the lower foothills adjacent to and east of the valley. Elevation ranges from 300 to 2,200 feet. Average annual rainfall ranges from 16 to 50 inches. This site occupies about 16,000 acres. About 6,000 acres consists of soils that have slopes in excess of 50 percent, about 5,000 acres have slopes of 30 to 50 percent, and about 5,000 acres have slopes that are less than 30 percent.

The soils in this site are in the Azule, Felton, and Los Osos series. They are well-drained clay loams and silt loams that are 20 inches to more than 60 inches deep over alluvium or fine-grained sandstones and shales. The subsoil is clay loam, gravelly sandy clay, or clay. These soils are slightly acid to medium acid in the surface layer and subsoil. Available water holding capacity is 4 to 10 inches. Permeability is moderately slow to slow. Fertility is moderate to high.

This site is mostly covered by open grass. Clusters of oaks are in pockets on north-facing slopes. When this site is producing at its potential, approximately 70 percent of the herbage is a mixture of wild oats, soft chess, burclover, and filaree, and remnant perennial grasses and other desirable plants. Approximately 20 percent is ripgut brome, annual fescues, wild barley, annual lupines, and other less desirable plants. The rest consists of tarweed, turkeymullein, thistles, mustard, and other undesirable plants.

The soils in this site, except AuG, AuG2, and LoG, are well suited to seeding with Hardinggrass and adapted annual grasses and legumes. Forage plants respond well to applications of nitrogen, phosphorus, and sulfur.

Brush is generally not a problem on this site. Thinning the clumps of trees increases forage production in some areas. The safe operation of equipment limits range improvement practices on this site to soils that have slopes of more than 50 percent.

Total annual production of air-dry forage on this site ranges from 3,600 pounds per acre in favorable years to 1,600 pounds per acre in unfavorable years.

LOAMY SITE

This site is on the mountain slopes on the east and west sides of the valley. Elevation ranges from 200 to 4,000 feet. The average annual rainfall ranges from 16 to 50 inches. This site occupies approximately 91,000 acres.

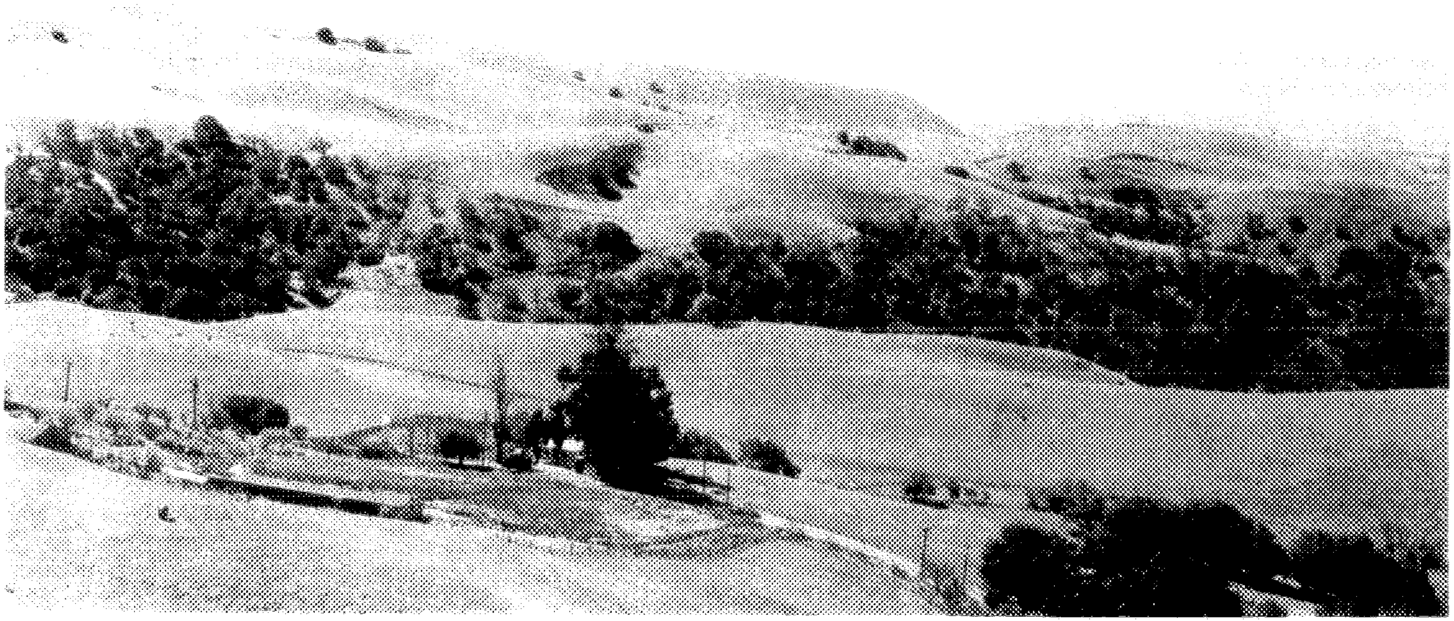

Figure 6.—An Altamont clay in the Clayey range site. The plant cover is open grass and individual oaks.

About 5,000 acres consists of soils that have slopes of less than 30 percent, about 14,500 acres have slopes of 30 to 50 percent, and 71,500 acres have slopes that are more than 50 percent.

The soils in this site are in the Gilroy, Los Gatos, Madonna, Parrish, Pleasanton, San Andreas, and Santa Lucia series. The land type Terrace escarpments is also in this site. These soils are well drained and have a fine sandy loam, loam, gravelly loam, shaly loam, clay loam, or gravelly clay loam surface layer and a sandy loam, loam, clay loam, gravelly clay loam, very shaly clay loam, or gravelly clay subsoil. The parent material is alluvium, sandstone, shale, or igneous rock. The surface layer is slightly acid to medium acid, and the subsoil is neutral to strongly acid. These soils are more than 18 inches deep to sandstone, shale, or igneous rock and in places are very deep. Permeability is moderately rapid to slow. Available water holding capacity is 2 to 9 inches. Fertility is moderate. In some places there are rock outcrops and the soil is eroded.

This site has a cover of open grass and of grass and oak trees. Presently there are many areas that are covered by brush. When this site is producing at its potential, approximately 70 percent of the herbage is a mixture of soft chess and filaree, some wild oats and burclover, a few remnant perennial grasses, and other desirable plants. Approximately 20 percent is ripgut brome, annual fescues, annual lupines, and other less desirable plants. The rest consists of turkeymullein, tarweed, California poppy, mustard, and other undesirable plants.

The soils in this site, except GoG, LfG, LhG, MbG, PfG, ScG, and TeF, are well suited to seeding with adapted annual grasses and legumes. Forage plants respond well to nitrogen, phosphorus, and sulfur fertilizers.

Brush control and tree thinning are desirable practices where equipment can be operated safely; that is, on slopes of less than 50 percent. Seeding and fertilizing are also desirable but must be restricted on steep slopes except for emergency erosion control.

Total annual production of air-dry forage on this site varies from 3,000 pounds per acre in favorable years to 1,200 pounds per acre in unfavorable years.

CLAYPAN SITE

This site is mainly on the low fans and terraces on the east side of the valley just south of San Martin. There are a few small areas in the higher foothills. Elevation ranges from 200 to 2,000 feet. The average annual rainfall ranges from 16 to 25 inches. This site occupies only about 4,400 acres. About two-thirds of the site has slopes that are less than 30 percent.

The soils in this site are in the Hillgate series. They are well drained and have a silt loam surface layer and a clay subsoil. The substratum is stratified gravelly clay loam. These soils are medium acid throughout the profile. The effective rooting depth is generally very deep. Permeability is very slow, and available water holding capacity is 6 to 7 inches. Fertility is low.

This site predominantly has an open cover of grass. When it is producing at its potential, approximately 70 percent of the herbage is a mixture of soft chess, filaree, and annual clovers, and there are small amounts of wild oats, burclover, and other desirable plants. Approximately 20 perecnt is ripgut brome, red brome, annual fescues, annual lupines, and other less desirable plants. The rest consists of nitgrass, tarweed, turkeymullein, vinegarweed, mustard, and other undesirable plants.

Some of the soils in this site (HfD2 and HfE2) are well suited to seeding with Hardinggrass and adapted annual grasses and legumes. Forage plants respond well to applications of nitrogen, phosphorus, and sulfur.

Total annual production of air-dry forage on this site ranges from 3,000 pounds per acre in favorable years to 1,200 pounds per acre in unfavorable years.

SHALLOW LOAMY SITE

This site is in the hills on both sides of the valley. Elevation ranges from 200 to 4,000 feet. The average annual rainfall ranges from 15 to 30 inches. This is the most extensive site in the survey area, and it occupies approximately 192,000 acres. About 64,000 acres consists of soils that have slopes of less than 30 percent, about 16,000 acres have slopes of 30 to 50 percent, and about 112,000 acres have slopes of more than 50 percent.

The soils in this site are in the Gaviota, Inks, and Vallecitos series. They are well drained and somewhat excessively drained and have a dominantly loam or gravelly clay loam surface layer and subsoil. They are 10 to 19 inches deep to sandstone, shale, and basic igneous rock. Available water holding capacity is 1 to 6 inches. Permeability is moderate to slow. Reaction is slightly acid to medium acid. Fertility is very low to moderate. In some places there are rock outcrops and the soils are eroded.

This site has a cover of open grass, of grass and oak trees, and, in many places, of brush. When this site is producing at its potential, approximately 70 percent of the herbage is a mixture of soft chess and filaree, moderate amounts of burclover and wild oats, and a few remnant perennial grasses and other desirable plants. About 20 percent is ripgut brome, annual fescue, annual lupines, and other less desirable plants. The rest consists of silver hairgrass, nitgrass, vinegarweed, tarweed, and other undesirable plants.

Some of the soils in this site (GcD2, GcE, GkE2, SaE2, and VaE2) are suited to seeding with adapted annual grasses and legumes, and these plants respond to nitrogen, phosphorus, and sulfur fertilizers. The other soils are not suited to such seeding. Areas selected for application of fertilizer should be free of brush and trees.

Brush control and tree thinning, which help to increase forage production, are practicable only on soils that have slopes of less than 50 percent.

Total annual production of air-dry forage on this site ranges from 2,400 pounds per acre in favorable years to 1,000 pounds per acre in unfavorable years.

SHALLOW GRAVELLY LOAM SITE

This low forage-producing site is almost entirely in a block on the tops and side slopes of the mountains along the Stanislaus County line, from Alameda County on the north nearly to Merced County on the south. Elevation ranges from 500 to 4,000 feet. Average annual rainfall is from 15 to 50 inches. Slopes are 15 to 75 percent. This site occupies about 70,000 acres. Large acreages of Rock land are closely associated with this site.

The soils in this site are in the Gaviota, Inks, and Maymen series. They are somewhat excessively drained and are gravelly loam, stony clay loam, or fine sandy loam that are 7 to 19 inches deep to hard, coarse-grained sandstone, basalt, and shale. Available water capacity is 1 to 3 inches. Permeability is moderately rapid to moderately slow. Reaction is slightly acid to strongly acid. Fertility is low to very low.

This site is predominantly covered by brush. Chamise is the principal species, but there is California sagebrush in badly eroded areas. When brush-free areas are producing at their potential, approximately 70 percent of the herbage is a mixture of soft chess, filaree, and a little burclover and wild oats. Pine bluegrass is about the only native perennial. Approximately 20 percent is ripgut brome, red brome, annual fescue, annual lupine, and other less desirable plants. The rest consists of silver hairgrass, vinegarweed, turkeymullein, and other undesirable plants.

The soils in this site and the slopes prevent range improvement through seeding, fertilizing, or brush clearing. Watersheds may be protected by seeding as an emergency treatment after wildfires.

Total annual production of air-dry forage on this site ranges from 1,200 pounds per acre in favorable years to 500 pounds in unfavorable years.

SERPENTINE SITE

This site is in a narrow strip in the low foothills just east of U.S. Highway 101. It starts at the northern boundary of the survey area and extends south to a point directly east of Morgan Hill. Elevation ranges from 800 to 3,000 feet. Average annual rainfall ranges from 16 to 25 inches. Slopes are from 15 to 75 percent. This site occupies about 8,500 acres.

The soils in this site are in the Henneke and Montara series. They are somewhat excessively drained and are clay loam and gravelly clay loam that is 10 to 18 inches deep to serpentine rock. Rock outcrops cover 5 to 10 percent of the surface. Permeability is moderately slow to slow. Available water holding capacity is 1 to 3 inches. Reaction is moderately alkaline. Fertility is low or very low.

This site is predominantly covered by open grass. When it is producing at its potential, approximately 60 percent of the herbage is a mixture of soft chess, filaree, and some annual clover. There are very small amounts of wild oats or burclover. In some areas, other desirable plants include purple needlegrass and squirreltail. Approximately 30 percent is ripgut brome, red brome, annual lupine, wild carrot, and large amounts of annual fescues and other less desirable plants. The rest consists of annual weeds, broadiaea, turkeymullein, and other undesirable plants. The soils in this site are not suited to seeding or fertilizing, except to produce a ground cover in critical areas.

Brush is normally not a problem on this site.

Total annual production of air-dry forage on this site ranges from 1,500 pounds per acre in favorable years to 700 pounds per acre in unfavorable years.

Wildlife and Fish[4]

Wildlife and fish are important in the Eastern Santa Clara Area, and the leasing of land for hunting can bring economic returns. There are large reservoirs that can be used for the production of fish. Important game species in the area are Columbian black-tailed deer, mourning doves, California quail, band-tailed pigeons, brush rabbits, and squirrels. Many nongame birds, such as finches, warblers, brushtits, and flycatchers, are also in the area.

Wildlife occupies a variety of habitats, and the nature of a particular habitat depends upon the characteristics of the soils and the vegetation growing on them. Table 3 gives the wildlife suitability groups in the survey area and rates them according to their suitability for specified plants important to wildlife. The list of plants is not complete for the area, but it contains the most important plants that can be used for habitat improvement. The plants included in table 3 are those that have widespread occurrence, are of value for different wildlife species, are appropriate for more than one suitability group, and are available for planting. No implication of value is intended in a wildlife rating, because the specific food and cover requirements of each wildlife species differ.

Wildlife suitability groups

The soils in the Eastern Santa Clara Area have been grouped into eight wildlife suitability groups. Following is a description of each group, including a brief description of the soils, vegetation, wildlife species, and suggested management. After the wildlife suitability groups, the use of ponds and reservoirs by waterfowl and for the production of fish is also discussed.

WILDLIFE SUITABILITY GROUP 1

This group consists of moderately deep to very deep soils that are moderately well drained to somewhat excessively drained. These soils are in the Arbuckle, Azule, Campbell, Cortina, Esparto, Garretson, Gilroy, Los Gatos, Los Osos, Los Robles, Madonna, Pacheco, Parrish, Pleasanton, Rincon, San Andreas, San Benito, Yolo, and Zamora series. These soils have slopes of 0 to 30 percent and are on alluvial plains, fans, low terraces, and uplands of the Santa Clara Valley and other small valleys. This group covers about 57,500 acres.

The surface layer ranges from fine sandy loam to silty clay loam and is gravelly or very gravelly in places. Permeability is moderately rapid to slow. Fertility is moderate to high. The available water holding capacity ranges from 2.5 to 12 inches. The Pacheco and Campbell soils are in this group because drainage has lowered the water table to a depth of more than 5 feet.

Natural vegetation consists of grasses, forbs, and scattered oak trees. Most of the soils in this group, however, have been cultivated. Under irrigation, they are used for row crops, including sugar beets, and for orchards and vineyards. On the uplands and in the small valleys, these soils are used for dryland grain, hay, pasture, and range.

A limited number of valley quail inhabit areas of these soils, and the number might increase if adequate watering facilities were available late in summer and early in fall. Food patches of wheat, barley, corn, or milo generally improve the habitat for these birds. The vineyards and orchards in this area also provide fairly good habitat for mourning doves, which prefer to feed in open areas where the ground cover is not too rank. Finches, warblers, titmice, flycatchers, and many other nongame birds are commonly found on this group of soils. Deer are mainly on the

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[4] WENDELL A. MILLER, biologist, Soil Conservation Service, Berkeley, California, helped to prepare this section.

TABLE 3.—*Suitability of specified plants to the soils in the wildlife suitability groups*

[An arabic number 1 means the plant named is suited to the wildlife group; 2 means suitability of the plant is fair to marginal for the wildlife group; dashes in the columns means the plant is not suited to soils of the wildlife group or its suitability is not known]

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
Alfalfa	[1] 1	1	----------	----------	----------	----------	----------	----------
Barley	1	1	2	1	----------	----------	1	----------
Blackberry	[1] 1	1	2	1	2	----------	1	----------
Buckwheat	1	2	2	----------	2	----------	1	2
Burclover	1	1	1	2	1	----------	1	2
Ceanothus	1	----------	2	----------	1	2	1	2
Chamise	1	----------	2	----------	1	1	1	2
Chaparral pea	[2] 1	----------	2	----------	1	----------	1	2
Cherry, hollyleaf	1	2	----------	----------	2	----------	1	----------
Coffeeberry	1	1	2	----------	1	----------	----------	2
Goar fescue	[1] 1	1	[1] 1	1	----------	----------	1	----------
Douglas-fir	[2] 1	----------	----------	----------	[2] 1	----------	1	[2] 2
Fiddleneck	1	1	1	----------	1	2	1	2
Filaree	1	1	1	----------	1	2	2	2
Hardinggrass	[1] 1	1	1	1	2	----------	2	----------
Lupine (annual)	1	1	1	----------	1	1	1	1
Mountain mahogany	1	2	----------	----------	1	----------	1	2
Manzanita	1	2	2	----------	1	2	1	2
Madrone	1	----------	----------	----------	[2] 1	----------	1	[2] 2
Oak, black	[2] 1	----------	----------	----------	[2] 1	----------	1	[2] 2
Oak, blue	1	1	2	----------	1	----------	2	2
Oak, California scrub	1	----------	----------	1	1	----------	1	2
Oak, live	1	2	2	1	1	----------	1	----------
Oak, valley	1	1	2	2	2	----------	1	----------
Pine, digger	1	2	2	2	1	----------	2	2
Poison oak	1	2	1	1	1	----------	1	2
Pyracantha	1	1	1	1	1	----------	1	----------
Rose, multiflora	1	1	1	1	1	2	1	2
Ryegrass	1	1	1	1	1	2	1	2
Sage, California	1	2	1	1	1	2	2	2
Softchess	1	1	1	2	1	2	1	2
Tarweed	1	1	1	1	1	2	2	2
Toyon	1	1	1	1	1	1	1	2
Turkey mullein	1	1	1	1	1	2	1	2
Vetch, Lana	1	1	1	1	1	----------	1	2
Vetch, Deer	1	1	1	1	1	2	1	2
Wheat	1	1	1	1	1	----------	1	2
Wildoats	1	1	1	1	1	2	1	2

[1] Irrigation water required on droughty soils.
[2] Requires 25 inches of rainfall or more.

uplands. Sometimes they move down to this area to feed in orchards, vineyards, and pastures.

WILDLIFE SUITABILITY GROUP 2

This group consists of moderately deep to very deep clays and silty clays that are well drained. Some areas of these soils are stony. These soils are in the Altamont, Campbell, Climara, Cropley, Diablo, Sunnyvale, and Zamora series. Some of the Campbell, Clear Lake, and Sunnyvale soils that have been drained are in this group. The land type Landslides is also in this group. Slopes are 0 to 75 percent. These soils are along the edge of the Santa Clara Valley and the foothill areas. This group covers approximately 15,000 acres.

Available water holding capacity of these soils is 3 to 12 inches. Fertility is moderate to high.

Natural vegetation consists of annual grasses and forbs, and of fairly dense stands of oak trees and brush on the north-facing slopes, in swales, and in gullies. Both annual and perennial grasses are mixed with a variety of weedy herbs, which are important sources of food for wildlife.

This group provides good habitat for both deer and California quail whenever water is available and where the brush and grassland intermingle. Mourning doves, band-tailed pigeons, cottontail rabbits, and nongame birds also use this habitat.

Soils that have slopes of less than 50 percent are suitable for habitat improvement. Ponds can be constructed where suitable damsites can be located. The leasing of hunting rights on these soils has good potential for economic returns for the landowner.

WILDLIFE SUITABILITY GROUP 3

This group consists of claypanlike soils that have a very slowly or slowly permeable subsoil or substratum and are well drained to moderately well drained. These soils are in the Hillgate, Keefers, and San Ysidro series, and in the San Ysidro series, acid variant. The topography is generally strongly sloping but ranges from nearly level to steep. Slopes are 0 to 50 percent. This group is on the older fans and terraces on both sides of the Santa Clara Valley. It covers about 17,000 acres.

The surface layer of these soils is loam, silt loam, or clay loam. Fertility is moderate to low. The available water holding capacity ranges from 5 to 9 inches.

Most areas of these soils are used for dryland grain, hay, and pasture, but irrigated orchards and vineyards are also grown. Undisturbed areas have a vegetative cover of annual grasses and forbs, a few scattered oak trees, and a little brush. Irrigation water is usually available for the soils on the older fans.

North-facing slopes can support cover suitable for deer. The soil depth in swales and hollows is generally sufficient to maintain some tree and shrub growth that is suitable for quail cover. Dove, finches, sparrows, and other nongame birds that eat seeds frequent the open grassland. Towhees, brushtits, and warblers use the bushy cover. Deer use these soils mainly in the winter and spring. The soils on low slopes have a fairly good potential for habitat improvement. A sufficient supply of water is generally available or can be developed for quail and other wildlife. Fishponds can be constructed on these soils where suitable damsites can be located.

WILDLIFE SUITABILITY GROUP 4

This group consists of wet soils that generally have a seasonal water table at a depth of 20 to 60 inches. Drainage is somewhat poor or poor. These soils are in the Campbell, Clear Lake, Pacheco, Sunnyvale, and Willows series. They have slopes of 0 to 2 percent and are on the valley floor. Some soils in this group are subject to flooding. This group covers about 5,500 acres.

The surface layer is fine sandy loam, clay loam, silty clay loam, or clay. Available water holding capacity is 6 to 13 inches. The Willows soil has moderate concentrations of salts.

The natural vegetation consists of annual grasses, forbs, and plants that require plenty of water. These soils are used for sugar beets, garlic, and pasture. A wide variety of shallow-rooted plants are suited to these soils. Irrigation water is usually available.

Uncultivated areas are used by deer, principally during winter. Mourning doves frequent the open areas. Limited numbers of California quail and cottontail rabbits are in favorable locations. A few ducks and geese also feed on pasture in this group. Ponds can be readily constructed on these soils. Except for the hazard of flooding, the soils in this group present few limitations to the development of wildlife habitat.

WILDLIFE SUITABILITY GROUP 5

This group consists of shallow to deep, well-drained soils on hard sedimentary and basic igneous rock. These soils are in the Gaviota, Gilroy, Los Gatos, Los Osos, Madonna, Parrish, San Benito, Santa Lucia, and Vallecitos series. They have slopes of 5 to 50 percent and are on the uplands on both sides of the Santa Clara Valley. This group covers about 85,500 acres.

The surface layer ranges from loam to clay loam and in some places is gravelly or shaly. Rock outcrops cover up to 10 percent of the surface in places. Some areas of these soils are eroded.

The natural vegetation is generally annual grasses, forbs, and scattered oak trees, but there is a fairly dense shrub and tree cover on the north-facing slopes and in swales and gullies. Grasses and a variety of weedy herbs are important sources of food for wildlife. Wildlife habitat is not so readily established on the soils that have extensive stands of heavy tree and brush cover as it is on the soils that have a cover of open grass and brush. These soils are used for pasture and range.

Deer and California quail occur where brushy draws on north-facing slopes are intermingled with open grassland. Mourning doves, band-tailed pigeons, many small birds, and brush rabbits also use this habitat.

Water is usually available for wildlife except late in summer. In winter, however, rainfall is adequate to make water developments feasible. Many livestock reservoirs have been constructed. Ponds can be constructed on the soils in this group where suitable sites exist. The leasing of hunting rights on these soils has good potential for economic returns for the landowner.

WILDLIFE SUITABILITY GROUP 6

This group consists of shallow, rocky soils formed on serpentine rock. These soils are in the Henneke, Maxwell, and Montara series. They have slopes of 15 to 75 percent and are mainly on both sides of the Santa Clara Valley in the uplands. Maxwell soils are on small alluvial fans. This group covers about 9,000 acres.

The surface layer is clay loam, and rock outcrops cover 2 to 10 percent of the surface. Fertility is low or very low. Available water holding capacity is 1 to 3 inches.

The natural vegetation is mainly annual grasses and forbs, but brush is dominant on the Henneke soils. The soils of this group are used for range, wildlife, recreation, and watershed.

Deer, rabbits, a few doves, quail, and nongame birds are on these soils. The soils in this group, however, have very low potential for the development of wildlife habitat.

WILDLIFE SUITABILITY GROUP 7

This group consists of moderately deep to deep, well-drained fine sandy loams and silt loams. These soils are in the Ben Lomond and Felton series. They are in the cooler, foggy, high-rainfall part of the Santa Cruz Mountains and have slopes of 15 to 75 percent. This group covers about 4,000 acres.

Available water holding capacity is 4 to 10 inches. Fertility is moderate.

The natural vegetation consists of redwood and Douglas-fir forests that contain such associated hardwood species as tan oak, live oak, and madrone, and various other trees and shrubs.

Game species are deer, band-tailed pigeons, California quail, brush rabbits, and gray squirrels. This group of soils also forms an ideal habitat for many species of nongame birds. Pure stands of mature timber on these soils provide protection and food for a limited number of deer, quail, and rabbits, and openings or regrowth areas provide an excellent habitat for these game species. These soils are suitable for many wildlife food and cover plants.

WILDLIFE SUITABILITY GROUP 8

This group consists of shallow to deep soils and land types that are well drained to somewhat excessively drained. These soils are in the Azule, Gaviota, Gilroy, Inks, Los Gatos, Los Osos, Madonna, Mayman, Parrish, San Andreas, San Benito, and Vallecitos series. Riverwash, Rock land, and Terrace escarpments are also included. These soils are on the uplands on both sides of the Santa Clara Valley and have slopes of 15 to 75 percent. This group covers about 327,000 acres.

The surface layer is loam, clay loam, or fine sandy loam and is gravelly, stony, or shaly in places. In some places rock outcrops cover up to 10 percent of the surface and the soils are eroded. Fertility is very low to high. The available water holding capacity is 1 to 10 inches.

The natural vegetation is generally annual grasses, forbs, and some scattered oak trees. There is a fairly dense cover of shrubs and trees on the north-facing slopes and in swales and gullies. The grasses and weedy herbs are important sources of food for wildlife. These soils are used mainly for range, wildlife, recreation, and watershed.

This group provides a good habitat for both deer and California quail, especially where brushy draws or north-facing slopes are intermingled with open grassland. Rabbits and gray squirrels and band-tailed pigeons, mourning doves, and other birds also use this habitat.

The physical characteristics of the soils in this group severely limit the potential for the development of wildlife habitat. The availability of water for wildlife is variable. The leasing of hunting rights has good potential for economic returns for the landowner.

PONDS AND RESERVOIRS

Most impoundments in this survey area are too small to attract large numbers of ducks. During the winter, Canada geese use Anderson and Coyote Reservoirs to some extent and graze on the adjacent grassland.

Livestock reservoirs and farm ponds are suitable for fish production. Those with cooler water are suitable for trout production, and the others are excellent for the production of black bass, sunfish, and channel catfish. Production of fish in a pond is dependent upon the fertility of the water, which in turn is influenced significantly by the fertility of the soils in the watershed, and to some extent by the soil on the bottom of the pond. Ponds on infertile soils produce less fish per acre.

Ponds and reservoirs have good potential for economic returns from fish production and recreation in hunting areas.

Engineering Uses of the Soils[5]

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, and pipelines, the foundations of buildings, facilities for storing water, structures for controlling erosion, drainage systems, and systems for disposing of sewage. Among the properties most important to the engineer are permeability to water, water holding capacity, shear strength, compaction characteristics, soil drainage, shrink-swell characteristics, grain size, plasticity, and soil reaction. Also important are depth to the water table, flooding hazard, depth to bedrock or to sand and gravel, and relief. Laboratory analysis is needed to accurately determine these qualities. Such information is made available in this section. Engineers can use it to—

1. Make soil and land use studies that will aid in selecting and developing industries, businesses, residences, and recreational areas.
2. Expedite planning and designing of erosion and flood control structures, drainage improvements, farm ponds, irrigation systems, diversion terraces, and other structures for conservation of soil and water.
3. Make preliminary evaluations of soil conditions that will aid in selecting locations for highways, airports, pipelines, and cables, and in planning more detailed surveys for the selected locations.
4. Locate probable sources of topsoil, sand, gravel, and other materials suitable for construction needs.
5. Correlate performance of engineering structures with mapping units to develop information for general planning that will be useful in designing and maintaining certain engineering practices and structures.
6. Supplement information obtained from other published maps and reports and aerial photographs.
7. Develop other preliminary estimates for construction purposes pertinent to the particular area.

It should be emphasized that the interpretations made in this soil survey do not eliminate the need for sampling and testing at a site chosen for a specific engineering work that involves heavy loads or at a site where excavations are to be deeper than the depths of the layers here reported. Nevertheless, by using this survey an engineer can select and concentrate on those soil units most important for his proposed kind of construction, and in this manner he can reduce the number of samples taken for laboratory testing and thus complete an adequate soil investigation at minimum cost.

The soil mapping units shown on the maps in this survey may include small areas of a different soil material. They are too small to be mapped separately and generally are not significant to farming in the area but may be important in engineering planning.

Information of value in planning engineering work is given throughout the text, particularly in the sections "Descriptions of the Soils" and "Formation and Classification of Soils."

Some of the terms used by the scientist may be unfamiliar to the engineer, and some words—for example, soil, clay, silt, and sand—may have a special meaning in soil science. These and other special terms used in the soil survey are defined in the Glossary at the back of this survey. Most of the information about engineering is given in tables 4, 5, and 6.

Engineering classification systems

Agricultural scientists of the U.S. Department of Agriculture classify soils according to texture (*10*). In some ways this system of naming textural classes is comparable to the systems most commonly used by engineers for classifying soils; that is, the system of the American Association of State Highway Officials (AASHO) and the Unified system.

AASHO system.—Most highway engineers classify soil materials in accordance with the system approved by the American Association of State Highway Officials (*1*). In this system soil materials are classified in seven principal groups.

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[5] E. C. JAHR, Soil Conservation Service, assisted in the preparation of this section.

TABLE 4.—*Engineering*

[Tests performed by the California

Soil series and location	Calif. report No.	Depth	Classification			Moisture density [4]		Atterberg values	
			USDA texture [1]	Unified [2]	AASHO [3]	Maximum dry density	Optimum moisture	Liquid limit	Plastic index
		Inches				*Lb. per cu. ft*			
Arbuckle: NW¼SE¼ sec. 22, R. 3 E., T. 9 S.	2732	0–6	Gravelly loam	SM–SC	A–4(1)	132	8	19	5
	2728	20–32	Gravelly loam	SM–SC	A–2–4(0)	138	8	18	5
	2714	40–60	Very gravelly sandy loam.	SM–SC	A–2–4(0)	142	8	24	7
Azule: NE¼SE¼ sec. 6, T. 10 S., R. 4 E.	2718	0–12	Clay loam	SC	A–6(4)	123	12	31	13
	2717	12–28	Gravelly sandy clay	SC	A–6(5)	117	13	39	19
	2712	48–60	Gravelly sandy clay loam.	SC	A–2–6(1)	128	11	34	15
Ben Lomond: NE¼NE¼ sec. 35, T. 10 S., R. 2 E.	2720	0–6	Fine sandy loam	SM	A–2–4(0)	113	15	[7] NP	[7] NP
	2716	15–27	Very fine sandy loam	SM	A–2–4(0)	124	10	NP	NP
Campbell: NW¼SW¼ sec. 35, T. 8 S., R. 2 E.	2729	8–27	Silty clay loam	CL	A–6(10)	112	16	34	15
	2715	40–68	Silty clay loam	CL	A–6(9)	122	10	29	13
Gilroy: NE¼SW¼ sec. 18, T. 11 S., R. 4 E.	2721	0–8	Clay loam	SM–SC [8]	A–2–6(0)	123	12	39	12
	2735	8–21	Clay loam	SM–SC	A–6–1	120	16	38	12
Hillgate: SW¼NW¼ sec. 8, T. 10 S., R. 4 E.	2730	5–10	Silt loam	ML–CL	A–4(6)	122	12	20	5
	2726	10–26	Clay	CL	A–7–6(12)	111	16	41	19
	2731	40–60	Gravelly clay loam	SC	A–6(2)	129	12	28	12
Los Gatos: NW¼SE¼ sec. 20, T. 10 S., R. 3 E.	2723	0–7	Gravelly loam	SC	A–4(0)	120	12	30	10
	2719	16–29	Gravelly clay loam	SM–SC	A–4(1)	128	11	22	7
Maymen: SW¼SW¼ sec. 15, T. 10 S., R. 2 E.	2724	3–14	Fine sandy loam	SM	A–4(1)	120	12	NP	NP
San Ysidro, acid variant: NE¼NW¼ sec. 18, T. 10 S., R. 4 E.	2733	4–10	Loam	ML–CL	A–4(6)	126	9	19	5
	2727	29–42	Clay	SC	A–6(3)	126	12	25	11
	2725	42–58	Gravelly clay loam	SC	A–2–4(0)	127	9	25	10
Sunnyvale: NE¼SE¼ sec. 34, T. 8 S., R. 2 E.	2722	14–34	Silty clay	CL	A–7–6(14)	115	13	45	23
	2734	42–60	Silty clay	CL	A–6(11)	121	13	35	17
Yolo: SE¼NW¼ sec. 35, T. 8 S., R. 2 E.	2713	7–18	Silty clay loam	CL	A–6(9)	116	15	30	12
	2711	36–67	Silty clay loam	CL	A–6(9)	125	11	28	12
Zamora: SE¼SW¼ sec. 4, T. 10 S., R. 3 E.	6421A	7–15	Clay loam	---	---	---	---	---	---
	6422A	15–26	Clay loam	---	---	---	---	---	---
	6423A	35–58	Fine sandy clay loam	---	---	---	---	---	---

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[1] By field determination. Mechanical analysis by the California Division of Highways procedure frequently may differ from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS).

[2] Based on the Unified Soil Classification System (*12*).

[3] Based on AASHO Designation M145–49 (*1*).

[4] Based on the method of testing for relative compaction of untreated and treated soils and aggregates, California test method No. 216E.

[5] Coefficient of linear extensibility of the whole soil (all size fractions). Fractional change of one dimension (thickness) of the soil upon wetting from ovendry to ⅓ bar water content. This special test was made by USDA Soil Survey Laboratory, Riverside, Calif.

test data

State Division of Highways]

COLE[5]	Mechanical analysis[6]														
	Percentage passing sieve—											Percentage smaller than—			
	3-in.	2-in.	1½-in.	1-in.	¾-in.	⅜-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.
In. per in.															
----------	------	100	99	98	97	89	82	73	59	53	41	36	25	13	8
----------	------	100	96	90	88	81	76	68	53	47	35	33	21	13	8
----------	100	96	91	84	80	73	64	47	28	23	16	15	8	6	8
----------	------	------	------	------	100	98	85	87	70	63	49	47	32	25	20
----------	------	------	------	100	99	95	87	79	66	59	46	44	34	29	24
----------	------	------	------	100	98	92	83	72	52	44	30	27	19	15	12
----------	------	------	------	------	------	------	100	96	76	62	34	31	14	6	3
----------	------	------	------	------	------	------	100	95	78	63	35	32	19	11	6
----------	------	------	------	------	------	------	--------	--------	100	99	94	90	67	43	31
----------	------	------	------	------	------	------	--------	100	98	94	78	73	52	35	26
----------	------	------	------	100	99	90	87	74	61	44	32	30	17	10	7
----------	------	------	100	99	99	95	90	82	58	48	36	33	22	13	9
0. 008	------	------	------	------	------	------	100	97	87	71	63	59	40	23	14
. 068	------	------	------	------	------	------	100	98	92	89	77	74	59	50	43
. 024	100	97	95	95	94	89	84	74	61	57	41	38	24	19	15
----------	------	------	100	99	98	95	89	74	52	47	36	35	24	14	7
----------	------	------	------	100	99	96	93	82	58	52	41	38	29	18	11
----------	------	------	------	------	------	------	100	95	82	74	39	35	21	14	8
----------	------	------	------	------	------	------	100	95	87	82	65	61	37	22	13
----------	------	------	------	------	------	------	100	92	75	68	48	44	28	21	19
----------	------	------	------	100	99	96	94	78	54	48	33	30	20	16	13
. 070	------	------	------	------	------	------	--------	100	99	98	94	92	67	47	36
. 045	------	------	------	------	------	------	--------	100	99	98	89	85	59	38	29
----------	------	------	------	------	------	------	--------	--------	100	99	91	86	58	49	29
----------	------	------	------	------	------	------	--------	--------	100	98	89	83	57	34	26
. 028	------	------	------	------	------	------	--------	--------	--------	--------	--------	--------	--------	--------	--------
. 057	------	------	------	------	------	------	--------	--------	--------	--------	--------	--------	--------	--------	--------
. 033	------	------	------	------	------	------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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[6] Mechanical analyses by California Division of Highways. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the SCS. In the California procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for uses in naming textural classes for soil.

[7] NP=Nonplastic.

[8] Soil Conservation Service and Bureau of Public Roads have agreed to consider that all soils having plasticity indexes within 2 points from A-line are to be given a borderline classification.

TABLE 5.—*Estimated*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in referring to other series that appear in the first column of this table. Landslides (LaF), Riverwash (Rg), Rock land (RnG), and Terrace than]

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification			Coarse fraction greater than 3 inches
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Feet	*Feet*	*Inches*				
Altamont: AcE, AcF, AcG2	2½–5	(1)	0–44	Clay	CH	A–7	0
			44	Shale.			
Arbuckle: AkC, ArA	3–5	(1)	0–40	Gravelly loam	SM or SC	A–4	0
			40–60	Very gravelly sandy loam (bedrock in places).	SM or SC	A–2	0
Azule: AuD2, AuE, AuE2, AuG, AuG2.	>5	(1)	0–12	Clay loam	SC	A–6	0
			12–48	Gravelly sandy clay	SC	A–6	0
			48–60	Gravelly sandy clay loam	SC	A–2	0
Ben Lomond: BeG	3–5	(1)	0–43	Fine sandy loam or very fine sandy loam.	SM	A–2	0
			43	Soft sandstone.			
Campbell:							
Ca, Cd	>5	(1)	0–68	Silty clay loam	CL	A–6	0
Cc	>5	3–5	0–36	Silty clay loam	CL	A–6	0
			36–60	Clay	CH	A–7	0
Ce	>5	2½–3½	0–36	Silty clay loam	CL	A–6	0
			36–60	Mucky clay	OH	A–7	0
Clear Lake: Cg, Ch, Ck	5+	2½–6	0–60	Clay	CH	A–7	0
Climara: ClD, CmE	1½–3½	(1)	0–27	Clay	CH	A–7	0
			27	Metamorphosed basic igneous rock.			
Cortina: CoB	5+	(1)	0–60	Very gravelly loam, fine sandy loam or sandy loam.	GM	A–1	0–5
Cropley: CrA, CrC	5+	(1)	0–60	Clay	CH	A–7	0
Diablo: DaD, DaF	2–5	(1)	0–40	Clay	CH	A–7	0
			40	Sandstone.			
Esparto: EsA, EsC	5+	(1)	0–14	Loam	ML	A–4	0
			14–48	Clay loam and silt loam	ML or CL	A–6	0
			48–60	Gravelly clay loam	SC	A–6	0
Felton: FaE, FaF, FaG	1½–5	(1)	0–48	Clay loam	CL	A–7	0
			48	Shale or sandstone.			
Garretson:							
GaA	5+	(1)	0–40	Loam	ML to CL	A–4	0–5
			40	Sand and gravel	GP	A–1	0–5
GbB	5+	(1)	0–60	Gravelly loam	ML to CL	A–4	0
*Gaviota: GcD2, GcE, GcG, GhG2, GhG3, GkE2, GmF. (For Los Gatos part of GmF, see the Los Gatos series.)	½–1½	(1)	0–19	Loam or gravelly loam	SM or SC	A–4	0
			19	Sandstone and shale.			
Gilroy: GoD, GoE2, GoF, GoG.	1½–3	(1)	0–21	Clay loam	SM or SC	A–2 or A–6	0
			21	Basic igneous rock.			

See footnotes at end of table.

engineering properties

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for escarpments (TeF) are so variable that their properties were not estimated. The symbol < means less than; the symbol > means more

Percentage passing sieve—				Atterberg values		Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity (uncoated steel)
No. 4	No. 10	No. 40	No. 200	Liquid limit	Plastic index						
						Inches per hour	*Inches per inch of soil*	*pH value*	*Mmhos./cm. at 25° C.*		
100	100	95–100	75–95	50–60	25–35	0. 06–0. 20	0. 14–0. 16	6. 6–8. 4	<1	High	High.
75–85	65–85	50–60	35–45	15–20	5–10	0. 63–2. 00	0. 12–0. 14	5. 6–6. 5	<1	Moderate	Low.
60–70	40–50	25–35	10–35	15–25	5–10	2. 00–6. 30	0. 05–0. 07	6. 1–6. 5	<1	Low	Low.
95–100	80–90	65–75	40–50	30–40	10–20	0. 20–0. 63	0. 19–0. 21	5. 6–6. 0	<1	Moderate	Moderate.
80–95	70–80	60–70	40–50	30–40	10–20	0. 06–0. 20	0. 12–0. 14	5. 6–6. 0	<1	High	High.
80–90	65–75	50–60	25–35	30–40	10–20	0. 06–0. 20	0. 11–0. 13	5. 6–6. 0	<1	Moderate	High.
100	95–100	75–80	30–35	[2] NP	[2] NP	2. 00–6. 30	0. 14–0. 16	5. 1–6. 5	<1	Low	Low.
100	100	95–100	75–95	25–35	10–20	0. 20–0. 63	0. 19–0. 21	7. 4–8. 4	<1	Moderate	High.
100	100	95–100	75–95	25–35	10–20	0. 20–0. 63	0. 19–0. 21	7. 4–8. 4	<1	Moderate	High.
100	100	95–100	85–95	50–60	30–35	0. 06–0. 20	0. 14–0. 16	8. 0–8. 4	<1	High	High.
100	100	95–100	75–95	25–35	10–20	0. 06–0. 20	0. 19–0. 21	7. 4–8. 4	<1	Moderate	High.
100	100	95–100	85–95	70–90	15–30	0. 20–0. 63	0. 23–0. 25	8. 0–8. 4	<1	High	High.
100	100	100	90–100	50–60	30–35	0. 06–0. 20	0. 14–0. 16	6. 6–8. 4	0–15	High	High.
100	80–90	85–95	75–85	50–60	30–35	0. 06–0. 20	0. 14–0. 16	6. 6–8. 4	<1	High	High.
70–85	20–50	15–40	5–20	NP	NP	6. 30–20. 0	0. 04–0. 07	6. 1–6. 5	<1	Low	Low.
100	100	100	95–100	50–60	30–40	0. 06–0. 20	0. 14–0. 16	6. 6–8. 4	<1	High	High.
100	100	100	95–100	50–60	30–40	0. 06–0. 20	0. 14–0. 16	7. 4–8. 4	<1	High	High.
100	100	75–80	60–75	30–35	0–10	0. 63–2. 00	0. 16–0. 18	5. 6–6. 0	<1	Moderate	Low.
100	100	90–95	70–80	35–40	10–15	0. 20–0. 63	0. 19–0. 21	6. 1–7. 3	<1	Moderate	Moderate.
70–80	65–70	50–60	40–50	30–35	10–15	0. 20–0. 63	0. 14–0. 16	6. 6–7. 3	<1	Moderate	Moderate.
100	100	95–100	75–85	40–50	25–30	0. 20–0. 63	0. 19–0. 21	5. 1–6. 0	<1	Moderate	Moderate.
90–100	85–95	75–85	60–70	20–30	0–10	0. 63–2. 00	0. 16–0. 18	6. 6–7. 3	<1	Moderate	Low.
40–50	30–40	20–30	0–5	NP	NP	>20. 0	0. 03–0. 05	6. 6–8. 4	<1	Low	Low.
90–100	80–85	70–80	55–65	20–30	0–10	0. 63–2. 00	0. 12–0. 14	6. 6–8. 4	<1	Moderate	Low.
75–80	75–90	60–70	40–50	30–40	5–10	0. 63–2. 00	0. 14–0. 16	6. 1–6. 5	<1	Low	Low.
85–95	85–95	55–65	30–40	30–40	10–20	0. 20–0. 63	0. 19–0. 21	5. 6–6. 0	<1	Moderate	Moderate.

TABLE 5.—*Estimated engineering*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification			Coarse fraction greater than 3 inches
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Feet	*Feet*	*Inches*				
Henneke: HeG3	1–1½	(1)	0–15 15	Very gravelly clay Serpentine rock.	GC	A–2	30–40
Hillgate: HfC, HfD2, HfE2, HfF2.	5+	(1)	0–10 10–40 40–60	Silt loam Clay and clay loam Gravelly clay loam	ML or CL CL or ML SC	A–4 A–6 or A–7 A–6	0 0 0
Inks: InG2, IsG3	1–1½	(1)	0–15 15	Gravelly clay loam Metamorphosed basalt.	SC or SM	A–2	0–5
Keefers: KeA, KeC2	>5	(1)	0–23 23–38 38–60	Clay loam Very gravelly clay loam Gravelly clay	CL GC or GM CL or ML	A–6 A–2 A–6	0 0 0
*Los Gatos: LfE2, LfF, LfG, LhG. (For the Gaviota part of LhG, see the Gaviota series.)	2–4	(1)	0–10 10–35 35	Gravelly loam Gravelly clay loam Shale.	SC or SM SC or SM	A–4 or A–6 A–4 or A–6	0 0
Los Osos: LoE, LoF, LoG	2–3½	(1)	0–10 10–36 36	Clay loam Clay Sandstone.	CL or ML CH	A–6 A–7	0 0
Los Robles: LrA, LrC	>5	(1)	0–14 14–60	Clay loam Gravelly clay loam	CL or ML CL	A–6 A–6	0 0
Madonna: MbE, MbF, MbG	2–2½	(1)	0–25 25	Loam Sandstone.	SM	A–4	0
Maxwell: McB	>5	(1)	0–46 46–60	Clay Gravelly clay loam	CH CL	A–7 A–6	0 0
Maymen: MeF2, MfG2	1–1½	(1)	0–14 14	Fine sandy loam Sandstone.	SM	A–4	0
Montara: MwF2	1–1½	(1)	0–13 13	Clay loam Serpentine rock.	CL	A–6	0
Pacheco: Pa, Pb, Pd	>5	3–6+	0–60	Clay loam, loam, and very fine sandy loam. (Surface layer is fine sandy loam or silt loam in places.)	ML or CL	A–6	0
Pe	>5	(1)	0–36 36–60	Clay loam and loam Gravel and sand	ML or CL GP	A–6 A–1	0 0–5
Parrish: PfE, PfF, PfG	2–3½	(1)	0–19 19–38 38	Gravelly clay loam Gravelly clay Shale.	ML or CL CH	A–4 A–7	0 0–10
Pleasanton: PoA, PoC, PpA, PpC, PpD2.	>5	(1)	0–60	Loam, gravelly clay loam and gravelly sandy clay loam.	ML or CL	A–6	0–10
Rincon: RaA, RaC2	>5	(1)	0–19 19–50 50–72	Clay loam Gravelly clay or clay Clay loam	CL CH ML	A–7 A–7 A–4	0 0 0
San Andreas: SaE2, SaG2	2–2½	(1)	0–23 23	Fine sandy loam Soft sandstone.	SM	A–2	0
San Benito: SbE2, SbF, SbF3, SbG.	2–4	(1)	0–39 39	Clay loam Shale.	CL	A–7	0

See footnotes at end of table.

properties—Continued

Percentage passing sieve—				Atterberg values		Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity (uncoated steel)
No. 4	No. 10	No. 40	No. 200	Liquid limit	Plastic index						
						Inches per hour	*Inches per inch of soil*	*pH value*	*Mmhos./cm. at 25° C.*		
40–50	40–45	30–40	20–30	50–60	25–35	0. 06–0. 20	0. 10–0. 12	6. 6–7. 3	<1	Moderate	High.
100	90–100	80–90	60–70	20–25	0–10	0. 63–2. 00	0. 19–0. 21	5. 6–6. 0	<1	Moderate	Moderate.
100	95–100	90–95	70–80	35–45	15–25	<0. 06	0. 04–0. 06	5. 6–6. 0	<1	High	High.
80–90	70–80	60–70	40–50	25–30	10–15	0. 20–0. 63	0. 15–0. 17	5. 6–6. 0	<1	Moderate	Moderate.
90–95	70–80	60–70	30–35	35–40	10–15	0. 20–0. 63	0. 15–0. 17	6. 1–6. 5	<1	Moderate	Moderate.
90–95	85–90	75–85	70–80	30–35	10–15	0. 20–0. 63	0. 18–0. 20	6. 1–6. 5	<1	Moderate	Moderate.
40–50	35–45	30–35	25–30	30–40	10–15	0. 06–0. 20	0. 12–0. 14	6. 6–7. 3	<1	Moderate	Moderate.
85–90	75–85	75–80	70–80	30–35	10–15	0. 06–0. 20	0. 04–0. 06	7. 4–7. 8	<1	Moderate	Moderate.
80–90	70–80	50–60	35–45	20–30	5–15	0. 63–2. 00	0. 12–0. 14	6. 1–6. 5	<1	Moderate	Low.
90–100	80–90	50–60	40–50	20–30	5–15	0. 20–0. 63	0. 15–0. 17	5. 6–6. 0	<1	Moderate	Moderate.
100	95–100	90–95	75–85	30–40	10–20	0. 20–0. 63	0. 19–0. 21	6. 1–6. 5	1	Moderate	Moderate.
100	95–100	90–95	80–90	50–60	30–40	0. 06–0. 20	0. 14–0. 16	6. 1–6. 5	1	High	High.
90–95	85–95	80–85	70–80	30–40	10–20	0. 20–0. 63	0. 19–0. 21	6. 6–7. 3	1	Moderate	Moderate.
80–85	65–75	60–70	50–60	30–40	15–20	0. 20–0. 63	0. 14–0. 16	6. 6–7. 3	1	Moderate	Moderate.
95–100	90–95	80–90	35–45	NP	NP	0. 63–2. 0	0. 16–0. 18	5. 6–6. 0	1	Moderate	Low.
100	100	95–100	90–95	50–70	40–55	0. 06–0. 20	0. 14–0. 16	6. 6–8. 4	1	High	High.
80–85	75–80	70–75	60 70	30–40	15–25	0. 06–0. 20	0. 14–0. 16	7. 9–8. 4	1	Moderate	High.
100	95–100	80–90	35–40	NP	NP	2. 00–6. 3	0. 13–0. 15	5. 1–6. 0	1	Low	Low.
90–100	90–100	90–95	85–95	30–40	20–35	0. 20–0. 63	0. 19–0. 21	7. 9–8. 4	1	Moderate	Moderate.
100	95–100	90–100	65–85	30–40	10–15	0. 63–2. 00	0. 16–0. 19	7. 9–8. 4	0–8	Moderate	High.
100	95–100	90–100	65–85	30–40	10–15	0. 63–2. 00	0. 19–0. 21	7. 9–8. 4	0–8	Moderate	High.
40–50	30–40	20–30	0–5	NP	NP	6. 30–20. 0	0. 03–0. 05	7. 9–8. 4	0–8	Low	Low.
75–85	70–80	65–70	60–65	20–40	5–10	0. 63–2. 00	0. 14–0. 15	5. 1–6. 0	<1	Moderate	High.
60–70	55–65	55–65	50–60	50–60	20–30	0. 06–0. 20	0. 11–0. 13	5. 1–5. 5	<1	High	High.
80–90	75–90	65–75	60–65	20–40	10–20	0. 20–0. 63	0. 13–0. 18	6. 1–7. 3	<1	Moderate	Moderate.
100	100	90–100	80–90	40–50	20–30	0. 20–0. 63	0. 19–0. 21	6. 6–7. 8	<1	Moderate	Moderate.
90–100	75–100	70–95	70–90	50–60	30–40	0. 06–0. 20	0. 12–0. 16	7. 4–8. 4	<1	High	High.
100	100	90–100	80–90	30–40	5–10	0. 20–0. 63	0. 19–0. 21	7. 9–8. 4	<1	Moderate	Moderate.
90–100	90–100	80–90	30–35	15–20	0–5	2. 00–6. 30	0. 13–0. 15	5. 6–6. 0	<1	Low	Low.
100	90–100	85–90	70–85	40–50	20–30	0. 20–0. 63	0. 19–0. 21	6. 6–8. 4	<1	Moderate	Moderate.

TABLE 5.—*Estimated engineering*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification			Coarse fraction greater than 3 inches
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Feet	*Feet*	*Inches*				
Santa Lucia: ScF2, ScG	2–3	(1)	0–23	Shaly and very shaly clay loam.	MH	A-5	0
			23	Shale.			
San Ysidro: SdA, SdB2	>5	(1)	0–20	Loam	CL-ML or CL	A-4	0
			20–36	Clay	SC or CL	A-6	0
			36–60	Clay loam or sandy clay loam.	SC	A-2 or A-4	0
San Ysidro, acid variant: SfA, SfC.	>5	(1)	0–29	Loam	ML to CL	A-4	0
			29–42	Clay	SC or CL	A-6	0
			42–58	Gravelly clay loam	SC	A-2 or A-4	0
Sunnyvale: Su, Sv	>5	2½–5+	0–60	Silty clay	CL	A-6 or A-7	0
Vallecitos: VaE2, VaG2	1–2½+	(1)	0–10	Loam	SM	A-4	0
			10–19	Clay loam and clay	CL or CH	A-7	0
			19	Shale.			
Willows: Wa	>5	1½–3½	0–60	Clay	CH	A-7	0
Yolo:							
YaA, YaB	>5	(1)	0–60	Loam and silt loam	ML	A-4 or A-5	0
YeA, YeC	>5	(1)	0–67	Silty clay loam	CL	A-6	0
*Zamora: ZaA, ZaC, ZbA, ZbC, ZeC3. (For Cropley part of ZeC3, see Cropley series.)	>5	(1)	0–58	Clay loam and sandy clay loam. (Surface layer is loam in places.)	CL	A-6	0–5

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[1] No observed water table to depth of study, which generally was 5 feet for soils not underlain by bedrock.

[2] NP=Nonplastic.

TABLE 6.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in referring to other series that appear in the first column of this table. Landslides (LaF), Riverwash (Rg)

Soil series and map symbols	Suitability as source of—			Hydrologic soil group	Soil features affecting—
	Topsoil	Sand and gravel	Road fill		Road location
Altamont: AcE, AcF, AcG2.	Poor: clay	Unsuitable for sand: 75 to 95 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A-7	D	2½ to 5 feet to rock; 15 to 75 percent slopes; high shrink-swell potential.
Arbuckle: AkC, ArA	Fair to poor: gravelly loam or loam over very gravelly sandy loam.	Fair to poor for sand: 10 to 45 percent passes No. 200 sieve. Fair to unsuitable for gravel: 15 to 60 percent gravel.	Fair to good: A-4, A-2.	B	3 to 5 feet or more to rock; 0 to 9 percent slopes; moderate shrink-swell potential.

properties—Continued

Percentage passing sieve—				Atterberg values		Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity (uncoated steel)
No. 4	No. 10	No. 40	No. 200	Liquid limit	Plastic index						
						Inches per hour	*Inches per inch of soil*	*pH value*	*Mmhos./cm. at 25° C.*		
70-80	65-70	50-65	40-50	70-85	0-10	0. 63-2. 00	0. 10-0. 12	5. 6-6. 0	<1	Moderate	Moderate.
95-100	90-95	80-90	50-65	15-25	5-10	0. 63-2. 00	0. 16-0. 18	5. 6-6. 5	<1	Moderate	Moderate.
95-100	90-95	75-85	45-55	25-35	10-20	<0. 06	0. 04-0. 06	6. 1-7. 3	<1	High	High.
85-95	70-80	50-60	30-40	20-30	5-10	0. 20-0. 63	0. 14-0. 16	7. 9-8. 4	<1	Moderate	Moderate.
95-100	90-95	80-90	50-65	15-25	5-10	0. 63-2. 00	0. 16-0. 18	5. 6-6. 0	<1	Moderate	Moderate.
95-100	90-95	75-85	45-55	25-35	10-20	<0. 06	0. 04-0. 06	5. 1-5. 5	<1	High	High.
90-95	75-80	50-60	30-40	20-30	5-10	0. 63-2. 00	0. 14-0. 16	5. 1-5. 5	<1	Moderate	High.
100	100	95-100	85-95	35-45	15-25	0. 06-0. 20	0. 15-0. 17	7. 9-8. 4	0-8	High	High.
85-95	80-90	55-80	40-50	30-40	5-10	0. 63-2. 00	0. 16-0. 18	5. 6-6. 5	<1	Moderate	Moderate.
85-95	80-90	65-80	55-65	40-60	25-35	0. 06-0. 20	0. 17-0. 19	5. 6-6. 0	<1	High	High.
100	100	95-100	90-95	50-60	30-40	0. 06-0. 20	0. 14-0. 16	7. 9-9. 0	4-15	High	High.
100	100	85-95	80-90	35-45	5-10	0. 63-2. 00	0. 17-0. 19	6. 6-7. 8	<1	Moderate	Low.
100	100	90-100	85-95	25-35	10-20	0. 20-0. 63	0. 19-0. 21	6. 1-8. 4	<1	Moderate	Moderate.
95-100	95-100	95-100	85-95	30-40	15-20	0. 20-0. 63	0. 19-0. 21	6. 6-7. 3	<1	Moderate	Moderate.

interpretations

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions fo
Rock land (RnG), and Terrace escarpments (TeF) are so variable that their properties were not estimated]

Soil features affecting—Continued				Soil limitations for septic tank filter fields
Water-retention structures		Agricultural drainage	Irrigation	
Embankments	Reservoir areas			
Fair to poor stability; fair to poor strength; high compressibility; good resistance to piping and cracking.	Slow permeability; 15 to 75 percent slopes; 2½ to 5 feet to rock.	Well drained; slow permeability; 2½ to 5 feet to rock.	15 to 75 percent slopes; 2½ to 5 feet to rock.	Severe: slow permeability; 15 to 75 percent slopes.
Fair stability; good strength; slight compressibility; good to poor resistence to piping and cracking.	Moderate permeability; 0 to 9 percent slopes; 3 to 5 feet or more to rock.	Well drained; moderate permeability; 3 to 5 feet or more to rock.	Moderate water holding capacity; moderately rapid intake rate; 0 to 9 percent slopes: 3 to 5 feet or more to rock.	ArA, slight. AkC, moderate: 3 to 5 feet or more to rock; 5 to 9 percent slopes.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			Hydrologic soil group	Soil features affecting—
	Topsoil	Sand and gravel	Road fill		Road location
Azule: AuD2, AuE, AuE2, AuG, AuG2.	Poor: clay loam over gravelly sandy clay and gravelly sandy clay loam.	Poor for sand: 25 to 50 percent passes No. 200 sieve. Poor to unsuitable for gravel: 10 to 35 percent gravel.	Poor to good: A–6, A–2.	C	9 to 75 percent slopes; high shrink-swell potential.
Ben Lomond: BeG	Fair: fine sandy loam; 3 to 5 feet to rock.	Poor for sand: 30 to 35 percent passes No. 200 sieve. Unsuitable for gravel: 0 to 5 percent gravel.	Good: A–2	B	3 to 5 feet to soft rock; 50 to 75 percent slopes; low shrink-swell potential.
Campbell:					
Ca, Cd	Fair: silty clay loam; water table below depth of 5 feet.	Unsuitable for sand: 75 to 95 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A–6	C	Moderate shrink-swell potential.
Cc	Fair: silty clay loam; clay at depth of 3 feet; water table at depth of 3 to 5 feet.	Unsuitable for sand: 75 to 95 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A–6, A–7 material at depth of 3 feet.	D	3 to 5 feet to water table, moderate shrink-swell potential to depth of 3 feet, high shrink-swell potential below.
Ce	Fair: silty clay loam; mucky clay at depth of 3 feet; water table at depth of 2½ to 3½ feet.	Unsuitable for sand: 75 to 95 percent passes No. 200 sieve. Unsuitable for gravel.	Poor to unsuitable: A–6, with organic A–7 material at depth of 3 feet.	D	2½ to 3½ feet to water table; moderate shrink-swell potential to depth of 3 feet, high shrink-swell organic materials below.
Clear Lake: Cg, Ch, Ck	Poor: clay	Unsuitable for sand: 90 to 100 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A–7	D	2½ to 6 feet to water table; high shrink-swell potential.
Climara: ClD, CmE	Poor: clay and stony clay; 1½ to 3½ feet to rock.	Unsuitable for sand: 75 to 85 percent passes No. 200 sieve. Unsuitable for gravel: 0 to 10 percent gravel.	Poor: A–7	D	1½ to 3½ feet to rock; 9 to 50 percent slopes; high shrink-swell potential.
Cortina: CoB	Poor: very gravelly sandy loam to very gravelly loam.	Fair for sand: 5 to 20 percent passes No. 200 sieve. Fair for gravel: 50 to 80 percent gravel.	Good: A–1	A	0 to 5 percent slopes; low shrink-swell potential.
Cropley: CrA, CrC	Poor: clay	Unsuitable for sand: 95 to 100 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A–7	D	0 to 9 percent slopes; high shrink-swell potential.
Diablo: DaD, DaF	Poor: clay; 2 to 5 feet to rock.	Unsuitable for sand: 95 to 100 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A–7	D	2 to 5 feet to rock; 9 to 50 percent slopes; high shrink-swell potential.

interpretations—Continued

Soil features affecting—Continued				Soil limitations for septic tank filter fields
Water-retention structures		Agricultural drainage	Irrigation	
Embankments	Reservoir areas			
Fair stability; good strength; slight compressibility; good resistance to piping; fair resistance to cracking.	Slow permeability; 9 to 75 percent slopes.	Well drained; slow permeability.	9 to 75 percent slopes____	Severe: slow permeability; 9 to 75 percent slopes.
Fair stability; good strength; slight compressibility; poor resistance to piping and cracking.	Moderately rapid permeability; 50 to 75 percent slopes; 3 to 5 feet to soft rock.	Well drained; moderately rapid permeability; 3 to 5 feet to soft rock.	50 to 75 percent slopes; 3 to 5 feet to soft rock.	Severe: 50 to 75 percent slopes.
Fair to good stability; fair strength; medium to high compressibility; good resistance to piping and cracking.	Moderately slow permeability; 5 feet or more to water table.	Somewhat poorly drained; moderately slow permeability; 5 feet or more to water table.	High water holding capacity; slow intake rate; 5 feet or more to water table.	Severe: moderately slow permeability; 5 feet or more to water table.
Fair to poor stability; fair to poor strength; medium to high compressibility; good resistance to piping and cracking.	Slow permeability; 3 to 5 feet to water table.	Somewhat poorly drained; slow permeability; 3 to 5 feet to water table.	High water holding capacity; slow intake rate; 3 to 5 feet to water table.	Severe: slow permeability; 3 to 5 feet to water table.
Not suitable for embankment materials below depth of 3 feet.	Slow permeability; 2½ to 3½ feet to water table; OH material at depth of 3 feet.	Somewhat poorly drained; slow permeability; 2½ to 3½ feet to water table.	High water holding capacity; slow intake rate; 2½ to 3½ feet to water table.	Severe: slow permeability; 2½ to 3½ feet to water table.
Fair to poor stability; fair to poor strength; high compressibility; good resistance to piping and cracking.	Slow permeability; 2½ to 6 feet to water table.	Slow permeability; 2½ to 6 feet to water table.	High water holding capacity; slow intake rate; 2½ to 6 feet to water table; some areas are saline.	Severe: slow permeability; 2½ to 6 feet to water table.
Fair to poor stability; fair to poor strength; high compressibility; good resistance to piping and cracking.	Slow permeability; 9 to 50 percent slopes; 1½ to 3½ feet to rock.	Slow permeability; 1½ to 3½ feet to rock.	Moderate water holding capacity; slow intake rate; 9 to 50 percent slopes; 1½ to 3½ feet to bedrock.	Severe: slow permeability; 1½ to 3½ feet to rock; 9 to 50 percent slopes.
Fair stability; good strength; slight compressibility; poor resistance to piping; fair resistance to cracking.	Rapid permeability; 0 to 5 percent slopes.	Somewhat excessively drained; rapid permeability.	Low water holding capacity; very rapid intake rate; 0 to 5 percent slopes.	Slight.
Fair to poor stability; fair to poor strength; high compressibility; good resistance to piping and cracking.	Slow permeability; 0 to 9 percent slopes.	Well drained; slow permeability.	High water holding capacity; slow intake rate; 0 to 9 percent slopes.	Severe: slow permeability.
Fair to poor stability; fair to poor strength; high compressibility; good resistance to piping and cracking.	Slow permeability; 9 to 50 percent slopes; 2 to 5 feet to rock.	Well drained; slow permeability; 2 to 5 feet to rock.	9 to 50 percent slopes; 2 to 5 feet to rock.	Severe: slow permeability; 9 to 50 percent slopes.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			Hydrologic soil group	Soil features affecting—
	Topsoil	Sand and gravel	Road fill		Road location
Esparto: EsA, EsC	Fair: loam over clay loam and gravelly clay loam.	Poor to unsuitable for sand: 40 to 80 percent passes No. 200 sieve. Poor to unsuitable for gravel; 0 to 35 percent gravel.	Fair to poor: A–4, A–6.	B	0 to 9 percent slopes; moderate shrink-swell potential.
Felton: FaE, FaF, FaG	Fair: clay loam 1½ to 5 feet to rock.	Unsuitable for sand: 75 to 85 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A–7	B	1½ to 5 feet to rock; 15 to 75 percent slopes moderate shrink-swell potential.
Garretson: GaA, GbB	Good to fair: loam and gravelly loam.	Good to unsuitable for sand; 0 to 70 percent passes No. 200 sieve. Fair to unsuitable for gravel: 5 to 70 percent gravel.	Fair to good: A–4, A–1.	B	0 to 5 percent slopes; moderate shrink-swell potential.
*Gaviota: GcD2, GcE, GcG, GhG2, GhG3, GkE2, GmF. (For Los Gatos part of GmF, see Los Gatos series.)	Poor: ½ to 1½ feet to rock.	Unsuitable for sand: ½ to 1½ feet to rock. Unsuitable for gravel: ½ to 1½ feet to rock.	Poor: A–4; ½ to 1½ feet to rock.	D	½ to 1½ feet to rock; 5 to 75 percent slopes; low shrink-swell potential.
Gilroy: GoD, GoE2, GoF, GoG.	Fair: clay loam; 1½ to 3 feet to rock.	Poor for sand: 30 to 40 percent passes No. 200 sieve. Poor to unsuitable for gravel; 5 to 15 percent gravel.	Good to poor: A–2, A–6.	C	1½ to 3 feet to rock; 5 to 75 percent slopes; moderate shrink-swell potential.
Henneke: HeG3	Poor: very gravelly clay; 1 to 1½ feet to rock.	Unsuitable for sand: 1 to 1½ feet to rock. Unsuitable for gravel: 1 to 1½ feet to rock.	Poor: A–2; 1 to 1½ feet to rock.	D	1 to 1½ feet to rock; 30 to 75 percent slopes; moderate shrink-swell potential.
Hillgate: HfC, HfD2, HfE2, HfF2.	Poor: silt loam over clay and gravelly clay loam.	Poor to unsuitable for sand: 40 to 80 percent passes No. 200 sieve. Poor to unsuitable for gravel: 0 to 30 percent.	Fair to poor: A–4, A–6, A–7.	D	2 to 50 percent slopes; high shrink-swell potential.
Inks: InG2, IsG3	Poor: gravelly clay loam; 1 to 1½ feet to rock.	Unsuitable for sand: 1 to 1½ feet to rock. Unsuitable for gravel: 1 to 1½ feet to rock.	Poor: A–2; 1 to 1½ feet to rock.	D	1 to 1½ feet to rock; 30 to 75 percent slopes; moderate shrink-swell potential.
Keefers: KeA, KeC2	Fair to poor: clay loam over very gravelly clay loam.	Poor to unsuitable for sand: 25 to 80 percent passes No. 200 sieve. Fair to unsuitable for gravel: 10 to 65 percent gravel.	Good to poor: A–6, A–2.	C	0 to 9 percent slopes; moderate shrink-swell potential.
*Los Gatos: LfE2, LfF, LfG, LhG. (For Gaviota part of LhG, see Gaviota series.)	Fair: gravelly loam over gravelly clay loam; 2 to 4 feet to rock.	Poor for sand: 35 to 50 percent passes No. 200 sieve. Poor to unsuitable for gravel: 10 to 30 percent gravel.	Fair to good: A–4, A–6.	B/C	2 to 4 feet to rock; 15 to 75 percent slopes; moderate shrink-swell potential.

interpretations—Continued

Soil features affecting—Continued				Soil limitations for septic tank filter fields
Water-retention structures		Agricultural drainage	Irrigation	
Embankments	Reservoir areas			
Fair to poor stability; fair to poor strength; medium to high compressibility; good to poor resistance to piping and cracking.	Moderately slow permeability; 0 to 9 percent slopes.	Moderately well drained; moderately slow permeability.	High water holding capacity; moderate intake rate; 0 to 9 percent slopes.	Severe: moderately slow permeability; 9 to 50 percent slopes.
Fair to good stability; fair strength; medium to high compressibility; good resistance to piping and cracking.	Moderately slow permeability; 1½ to 5 feet to rock; 15 to 75 percent slopes.	Well drained; moderately slow permeability; 1½ to 5 feet to rock.	15 to 75 percent slopes; 1½ to 5 feet to rock.	Severe: moderately slow permeability; 15 to 75 percent slopes.
Poor stability; fair strength; medium compressibility; poor resistance to piping and cracking.	Moderate permeability (very rapid in GaA below depth of 40 inches); 0 to 5 percent slopes.	Well drained; moderate permeability (very rapid below 40 inches in unit GaA).	High water holding capacity; moderate intake rate; 0 to 5 percent slopes.	Slight.
Fair stability; good strength; slight compressibility; good to poor resistance to piping and cracking; ½ to 1½ feet to rock.	Moderate permeability; ½ to 1½ feet to rock; 5 to 75 percent slopes.	Somewhat excessively drained and well drained; moderate permeability; ½ 1½ feet to rock.	5 to 75 percent slopes; ½ to 1½ feet to rock.	Severe: ½ to 1½ feet to rock; 5 to 75 percent slopes.
Fair stability; good strength; slight compressibility; good to poor resistance to piping and cracking.	Moderately slow permeability; 5 to 75 percent slopes; 1½ to 3 feet to rock.	Well drained; moderately slow permeability; 1½ to 3 feet to rock.	5 to 75 percent slopes; 1½ to 3 feet to rock.	Severe: moderately slow permeability; 5 to 75 percent slopes.
Fair stability; good strength; slight compressibility; good resistance to piping; fair resistance to cracking. 1 to 1½ feet to rock.	Slow permeability; 30 to 75 percent slopes; 1 to 1½ feet to rock.	Somewhat excessively drained; slow permeability; 1 to 1½ feet to rock.	30 to 75 percent slopes; 1 to 1½ feet to rock.	Severe: slow permeability; 1 to 1½ feet to rock; 30 to 75 percent slopes.
Fair to poor stability; fair strength; medium to high compressibility; good to poor resistance to piping and cracking.	Very slow permeability; 2 to 50 percent slopes.	Well drained; very slow permeability.	Moderate to high water holding capacity; moderate intake rate; 2 to 50 percent slopes; very slow permeability.	Severe: very slow permeability; 2 to 50 percent slopes.
Fair stability; good strength; slight compressibility; good resistance to piping; fair resistance to cracking; 1 to 1½ feet to rock.	Moderately slow permeability; 30 to 75 percent slopes; 1 to 1½ feet to rock.	Somewhat excessively drained; moderately slow permeability; 1 to 1½ feet to rock.	30 to 75 percent slopes; 1 to 1½ feet to rock.	Severe: moderately slow permeability; 1 to 1½ feet to rock; 30 to 75 percent slopes.
Fair to good stability; fair to good strength; slight to high compressibility; good resistance to piping; good to fair resistance to cracking.	Slow permeability; 0 to 9 percent slopes.	Well drained; slow permeability.	Moderate water holding capacity; moderately slow intake rate: 0 to 9 percent slopes.	Severe: slow permeability.
Fair stability; good strength; slight compressibility; good resistance to piping; fair resistance to cracking.	Moderately slow permeability; 15 to 75 percent slopes; 2 to 4 feet to rock.	Well drained; moderately slow permeability; 2 to 4 feet to rock.	15 to 75 percent slopes; 2 to 4 feet to rock.	Severe: moderately slow permeability; 15 to 75 percent slopes.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			Hydrologic soil group	Soil features affecting—
	Topsoil	Sand and gravel	Road fill		Road location
Los Osos: LoE, LoF, LoG.	Poor: clay loam over clay; 2 to 3½ feet to rock.	Unsuitable for sand: 75 to 90 percent passes No. 200 sieve. Unsuitable for gravel: 0 to 5 percent gravel.	Poor: A-6, A-7.	C	2 to 3½ feet to rock; 15 to 75 percent slopes; high shrink-swell potential.
Los Robles: LrA, LrC	Fair: clay loam over gravelly clay loam.	Unsuitable for sand: 50 to 85 percent passes No. 200 sieve. Poor to unsuitable for gravel: 5 to 35 percent gravel.	Poor: A-6	B	0 to 9 percent slopes; moderate shrink-swell potential.
Madonna: MbE, MbF, MbG.	Fair; loam, 2 to 2½ feet to rock.	Poor for sand: 35 to 45 percent passes No. 200 sieve. Unsuitable for gravel: 5 to 10 percent gravel.	Fair: A-4	C	2 to 2½ feet to rock; 15 to 75 percent slopes; moderate shrink-swell potential.
Maxwell: McB	Poor: clay over gravelly clay loam.	Unsuitable for sand: 60 to 95 percent passes No. 200 sieve. Unsuitable for gravel: 0 to 25 percent gravel.	Poor: A-7, A-6.	D	0 to 5 percent slopes; high shrink-swell potential.
Maymen: MeF2, MfG2.	Poor: 1 to 1½ feet to rock.	Unsuitable for sand: 1 to 1½ feet to rock. Unsuitable for gravel: 1 to 1½ feet to rock.	Poor: A-4; 1 to 1½ feet to rock.	D	1 to 1½ feet to rock; 15 to 75 percent slopes; low shrink-swell potential.
Montara: MwF2	Poor: 1 to 1½ feet to rock.	Unsuitable for sand: 1 to 1½ feet to rock. Unsuitable for gravel: 1 to 1½ feet to rock.	Poor: A-6; 1 to 1½ feet to to rock.	D	1 to 1½ feet to rock; 15 to 50 percent slopes; moderate shrink-swell potential.
Pacheco: Pa, Pb, Pd	Fair to good: 3 to 6 feet or more to water table; stratified clay loam to sandy loam.	Unsuitable for sand: 65 to 85 percent passes No. 200 sieve. Unsuitable for gravel: 0 to 5 percent gravel.	Poor: A-6	B/C, drained	3 to 6 feet or more to water table; moderate shrink-swell potential.
Pe	Fair to good: stratified clay loam to sandy loam; 36 to 40 inches to stratified sand and gravel.	Unsuitable to good for sand: 0 to 85 percent passes No. 200 sieve. Fair to unsuitable for gravel: 0 to 70 percent gravel.	Poor to good: A-6, A-1.	B/C, drained	Moderate shrink-swell potential.
Parrish: PfE, PfF, PfG	Poor: gravelly clay loam over gravelly clay; 2 to 3½ feet to rock.	Unsuitable for sand: 50 to 65 percent passes No. 200 sieve. Poor to unsuitable for gravel: 20 to 45 percent gravel.	Fair to poor: A-4, A-7.	C	2 to 3½ feet to rock; 9 to 75 percent slopes; high shrink-swell potential.

interpretations—Continued

Soil features affecting—Continued				Soil limitations for septic tank filter fields
Water-retention structures		Agricultural drainage	Irrigation	
Embankments	Reservoir areas			
Fair stability; fair to poor strength; medium to high compressibility; good resistance to piping and cracking.	Slow permeability; 15 to 75 percent slopes; 2 to 3½ feet to rock.	Well drained; slow permeability; 2 to 3½ feet to rock.	15 to 75 percent slopes; 2 to 3½ feet to rock.	Severe: slow permeability; 15 to 75 percent slopes.
Fair to good stability; fair strength; medium to high compressibility; good resistance to piping and cracking.	Moderately slow permeability; 0 to 9 percent slopes.	Well drained; moderately slow permeability.	High water holding capacity; moderately slow intake rate; 0 to 9 percent slopes.	Severe: moderately slow permeability.
Fair stability; good strength; slight compressibility; poor resistance to piping; fair to poor resistance to cracking.	Moderate permeability; 15 to 75 percent slopes; 2 to 2½ feet to rock.	Well drained; moderate permeability; 2 to 2½ feet to rock.	15 to 75 percent slopes; 2 to 2½ feet to rock.	Severe: 15 to 75 percent slopes; 2 to 2½ feet to rock.
Fair stability; fair to poor strength; medium to high compressibility; good resistance to piping and cracking.	Slow permeability; 0 to 5 percent slopes.	Moderately well drained; slow permeability.	High water holding capacity; slow intake rate; 0 to 5 percent slopes.	Severe: slow permeability.
Fair stability; good strength; slight compressibility; poor resistance to piping; fair to poor resistance to cracking; 1 to 1½ feet to rock.	Moderately rapid permeability 15 to 75 percent slopes; 1 to 1½ feet to rock.	Somewhat excessively drained; moderately rapid permeability; 1 to 1½ feet to rock.	15 to 75 percent slopes; 1 to 1½ feet to rock.	Severe: 15 to 75 percent slopes; 1 to 1½ feet to rock.
Fair to good stability; fair strength; medium to high compressibility; good resistance to piping and cracking; 1 to 1½ feet to rock.	Moderately slow permeability; 15 to 50 percent slopes; 1 to 1½ feet to rock.	Somewhat excessively drained; moderately slow permeability; 1 to 1½ feet to rock.	15 to 50 percent slopes; 1 to 1½ feet to rock.	Severe: moderately slow permeability; 15 to 50 percent slopes; 1 to 1½ feet to rock.
Poor to good stability; fair strength; medium to high compressibility; good to poor resistance to piping and cracking.	Moderate permeability; 3 to 6 feet or more to water table.	Poorly drained (Pb has been drained) moderate permeability; 3 to 6 feet or more to water table.	High water holding capacity; moderate to moderately slow intake rate; 3 to 6 feet or more to water table.	Severe: 3 to 6 feet or more to water table.
Poor to good stability; fair to good strength; very slight to high compressibility; good to poor resistance to piping and cracking.	Moderate permeability (rapid below depth of 36 inches).	Moderately well drained; moderate permeability (rapid below depth of 36 inches).	High water holding capacity; moderately slow intake rate.	Moderate to slight; moderate permeability (rapid below depth of 36 inches).
Fair stability; fair strength; medium to high compressibility; good to poor resistance to piping and cracking.	Slow permeability; 9 to 75 percent slopes; 2 to 3½ feet to rock.	Well drained; slow permeability; 2 to 3½ feet to rock.	9 to 75 percent slopes; 2 to 3½ feet to rock.	Severe: slow permeability; 9 to 75 percent slopes.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			Hydrologic soil group	Soil features affecting—
	Topsoil	Sand and gravel	Road fill		Road location
Pleasanton: PoA, PoC, PpA, PpC, PpD2.	Fair: loam or gravelly loam over gravelly clay loam.	Unsuitable for sand: 60 to 65 percent passes No. 200 sieve. Unsuitable for gravel: 10 to 25 percent gravel.	Poor: A-6	B	0 to 15 percent slopes; moderate shrink-swell potential.
Rincon: RaA, RaC2	Poor: clay loam over gravelly clay and clay.	Unsuitable for sand: 70 to 90 percent passes No. 200 sieve. Unsuitable for gravel: 0 to 25 percent gravel.	Poor to fair: A-7, A-4.	D	0 to 9 percent slopes; high shrink-swell potential.
San Andreas: SaE2, SaG2.	Fair: fine sandy loam; 2 to 2½ feet to soft rock.	Poor for sand: 30 to 35 percent passes No. 200 sieve. Unsuitable for gravel: 0 to 10 percent gravel.	Good: A-2	C	2 to 2½ feet to soft rock; 15 to 75 percent slopes; low shrink-swell potential.
San Benito: SbE2, SbF, SbF3, SbG.	Fair: clay loam; 2 to 4 feet to rock.	Unsuitable for sand: 70 to 85 percent passes No. 200 sieve. Unsuitable for gravel: 0 to 10 percent gravel.	Poor: A-7	B	2 to 4 feet to rock; 15 to 75 percent slopes; moderate shrink-swell potential.
Santa Lucia: ScF2, ScG	Poor: shaly and very shaly clay loam; 2 to 3 feet to rock.	Unsuitable for sand: 40 to 50 percent passes No. 200 sieve. Poor for gravel: 30 to 35 percent gravel.	Fair: A-5	C	2 to 3 feet to rock; 30 to 75 percent slopes; moderate shrink-swell potential.
San Ysidro: SdA, SdB2	Poor: loam over clay and clay loam.	Poor to unsuitable for sand: 30 to 65 percent passes No. 200 sieve. Unsuitable for gravel: 5 to 30 percent gravel.	Good to poor: A-4, A-6, A-2.	D	0 to 5 percent slopes; high shrink-swell potential.
San Ysidro, acid variant: SfA, SfC.	Poor: loam over clay and gravelly clay loam.	Poor to unsuitable for sand: 30 to 65 percent passes No. 200 sieve. Unsuitable for gravel: 5 to 30 percent gravel.	Good to poor: A-4, A-6, A-2.	D	0 to 9 percent slopes; high shrink-swell potential.
Sunnyvale: Su, Sv	Poor: silty clay; 2½ to 5 feet or more to water table.	Unsuitable for sand: 85 to 95 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A-6, A-7.	C	2½ to 5 feet or more to water table; high shrink-swell potential.
Vallecitos: VaE2, VaG2	Poor: loam over clay loam and clay; 1 to 2½ feet to rock.	Poor to unsuitable for sand: 40 to 65 percent passes No. 200 sieve. Unsuitable for gravel: 10 to 20 percent gravel.	Fair to poor: A-4, A-7; 1 to 2½ feet to rock.	C	1 to 2½ feet to rock; 15 to 75 percent slopes; high shrink-swell potential.
Willows: Wa	Poor: clay; 2 to 4 feet to water table.	Unsuitable for sand: 90 to 95 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A-7	D	1½ to 3½ feet to water table; high shrink-swell potential.

interpretations—Continued

Soil features affecting—Continued				Soil limitations for septic tank filter fields
Water-retention structures		Agricultural drainage	Irrigation	
Embankments	Reservoir areas			
Fair to poor stability; fair strength; medium to high compressibility; good to poor resistance to piping and cracking.	Moderately slow permeability; 0 to 15 percent slopes.	Well drained; moderately slow permeability.	High water holding capacity; moderate intake rate; 0 to 15 percent slopes.	Severe: moderately slow permeability.
Fair to poor stability; fair to poor strength; medium to high compressibility; good to poor resistance to piping and cracking.	Slow permeability; 0 to 9 percent slopes.	Well drained; slow permeability.	High water holding capacity; slow intake rate; 0 to 9 percent slopes.	Severe: slow permeability.
Fair stability; good strength; slight compressibility; poor resistance to piping; fair to poor resistance to cracking.	Moderately rapid permeability; 15 to 75 percent slopes; 2 to 2½ feet to soft rock.	Well drained; moderately rapid permeability; 2 to 2½ feet to soft rock.	15 to 75 percent slopes; 2 to 2½ feet to soft rock.	Severe: 15 to 75 percent slopes; 2 to 2½ feet to soft rock.
Fair to good stability; fair strength; medium to high compressibility; good resistance to piping and cracking.	Moderately slow permeability; 15 to 75 percent slopes; 2 to 4 feet to rock.	Well drained; moderately slow permeability; 2 to 4 feet to rock.	15 to 75 percent slopes; 2 to 4 feet to rock.	Severe: moderately slow permeability; 15 to 75 percent slopes.
Poor stability; poor strength; very high compressibility; fair to poor resistance to piping and cracking.	Moderate permeability; 30 to 75 percent slopes; 2 to 3 feet to rock.	Well drained; moderate permeability; 2 to 3 feet to rock.	30 to 75 percent slopes; 2 to 3 feet to rock.	Severe: 30 to 75 percent slopes; 2 to 3 feet to rock.
Fair to poor stability; fair to good strength; slight to high compressibility; good to poor resistance to piping and cracking.	Very slow permeability; 0 to 5 percent slopes.	Moderately well drained; very slow permeability.	Moderate to high water holding capacity; moderate intake rate; 0 to 5 percent slopes.	Severe: very slow permeability.
Fair to poor stability; fair to good strength; slight to high compressibility; good to poor resistance to piping and cracking.	Very slow permeability; 0 to 9 percent slopes.	Moderately well drained; very slow permeability.	Moderate to high water holding capacity; moderate intake rate; 0 to 9 percent slopes.	Severe: very slow permeability.
Fair to good stability; fair strength; medium to high compressibility; good reisistance to piping and cracking.	Slow permeability; 2½ to 5 feet or more to water table.	Poorly drained; slow permeability; 2½ to 5 feet or more to water table.	High water holding capacity; slow intake rate; 2½ to 5 feet or more to water table; some areas are saline.	Severe: slow permeability; 2½ to more than 5 feet to water table.
Fair to poor stability; good to fair strength; slight to high compressibility; good to poor resistance to piping and cracking; 1 to 2½ feet to rock.	Slow permeability; 15 to 75 percent slopes; 1 to 2½ feet to rock.	Well drained; slow permeability; 1 to 2½ feet to rock.	Low to moderate water holding capacity; moderate intake rate; 15 to 75 percent slopes; 1 to 2½ feet to rock.	Severe: slow permeability; 15 to 75 percent slopes.
Fair to poor stability; fair to poor strength; high compressibility; good resistance to piping and cracking.	Slow permeability; 1½ to 3½ feet to water table.	Poorly drained; slow premeability; 1½ to 3½ feet to water. table	High water holding capacity; slow intake rate; 1½ to 3½ feet to water table; saline.	Severe: slow permeability; 1½ to 3½ feet to water table.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			Hydrologic soil group	Soil features affecting—
	Topsoil	Sand and gravel	Road fill		Road location
Yolo:					
YaA, YaB	Good: loam and silt loam.	Unsuitable for sand: 80 to 90 percent passes No. 200 sieve. Unsuitable for gravel.	Fair: A-4, A-5.	B	0 to 5 percent slopes; moderate shrink-swell potential.
YeA, YeC	Fair: silty clay loam.	Unsuitable for sand: 85 to 95 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A-6	B	0 to 9 percent slopes; moderate shrink-swell potential.
*Zamora: ZaA, ZaC, ZbA, ZbC, ZeC3. (For Cropley part of ZeC3, see the Cropley series.)	Fair: loam or clay loam over clay loam.	Unsuitable for sand: 85 to 95 percent passes No. 200 sieve. Unsuitable for gravel: 0 to 5 percent gravel.	Poor: A-6	B	0 to 9 percent slopes; moderate shrink-swell potential.

The groups range from A-1 (gravelly soils having high bearing capacity, the best soils for subgrade) to A-7 (clayey soils having low strength when wet, the poorest soils for subgrade). Within each group the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best materials to 20 for the poorest. The group index number for the soils tested is shown in parentheses after the soil group symbol in table 4.

Unified system.—Some engineers prefer to use the Unified Soil Classification System (*12*). In this system soil materials are identified as coarse grained, 8 classes (GW, GP, GM, GC, SW, SP, SM, SC); fine grained, 4 classes (ML, CL, MH, CH); and highly organic, 3 classes (OL, OH, Pt). Table 4 shows the classification of the tested soils according to the Unified system.

Engineering test data

Table 4 gives test data for samples of selected layers taken from the profiles of some extensive soils of the survey area. The samples were taken in representative sites and were tested by the California State Division of Highways.

The data in table 4 shows the soil classifications under the USDA, the Unified, and the AASHO systems; moisture density; Atterberg values; coefficient of linear extensibility; and the mechanical analysis of the soil samples tested.

The relation of moisture content and the density to which a soil material can be compacted are important for engineering purposes. If soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The moisture content at which the maximum dry density is obtained is the optimum moisture content.

The tests for liquid limit and plastic limit measure the effect of water on consistence of the soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The *plastic limit* is the moisture content at which the soil material passes from a semisolid to a plastic state. The *liquid limit* is the moisture content at which the soil material passes from a plastic to a liquid state. The *plasticity index* is the numerical difference between liquid limit and plastic limit. It indicates the range in moisture content within which a soil material is in a plastic condition.

Also shown in table 4 is the capacity of the soils to expand. The procedure to determine the coefficient of linear extensibility was carried out on undisturbed, unconfined (except by moisture tension) samples. It determines the vertical component of volume change upon drying from a moisture tension of 1/3 atmosphere to oven dryness. The data on the coefficient of linear extensibility is useful in working with soil in a natural condition. Road construction, foundations of structures, and reservoir sites are all affected by high shrink-swell characteristics.

Mechanical analysis was determined by the sieve and hydrometer method. The data shows the relative proportions of the particles of different sizes in the soil material. The size and proportions of the particles affect the behavior of soil material when it is used for engineering purposes.

Estimated engineering properties

Table 5 lists the soil series and map symbols in the survey area. It also gives estimates of soil properties significant to some engineering work. Landslides, riverwash, Rock land, and Terrace escarpments, however, are not listed in the table. These land types are too variable in characteristics to be rated or otherwise are not suitable for engineering use.

interpretations—Continued

Soil features affecting—Continued				Soil limitations for septic tank filter fields
Water-retention structures		Agricultural drainage	Irrigation	
Embankments	Reservoir areas			
Poor stability; fair strength; medium compressibility; poor resistance to piping and cracking.	Moderate permeability; 0 to 5 percent slopes.	Well drained; moderate permeability.	High water holding capacity; moderate intake rate; 0 to 5 percent slopes.	Moderate: moderate permeability.
Fair to good stability; fair strength; medium to high compressibility; good resistance to piping and cracking.	Moderately slow permeability; 0 to 9 percent slopes.	Well drained; moderately slow permeability.	High water holding capacity; moderately slow intake rate; 0 to 9 percent slopes.	Severe: moderately slow permeability.
Fair to good stability; fair strength; medium to high compressibility; good resistance to piping and cracking.	Moderately slow permeability; 0 to 9 percent slopes.	Well drained; moderately slow permeability.	High water holding capacity; moderate to moderately slow intake rate; 0 to 9 percent slopes.	Severe: moderately slow permeability.

Given in table 5 are the depth to rock, depth to seasonal high water table, and the estimated USDA, Unified, and AASHO soil classifications. In addition, estimates of the percentages of material passing through the various sieves are given. Also shown are estimates of the Atterberg values, permeability, available water capacity, reaction, salinity, shrink-swell potential, and corrosivity of uncoated steel.

The estimates are based partly on examinations made in the field and partly on results of test data shown in table 4. Since the estimates are only for typical soils, considerable variation from these values should be anticipated. More information on the range of properties of the soils can be obtained in other parts of this survey, particularly in the section "Descriptions of the Soils."

According to the system used by soil scientists of the U.S. Department of Agriculture, the basic textural class name is based on the size distribution of the material smaller than 2.0 millimeters in diameter. The material smaller than 2.0 millimeters in diameter is classified into three size fractions—sand, silt, or clay. The percentage of the three size fractions determines the textural classification. The prefix "gravelly" or "cobbly" is used if the soil is 15 to 35 percent gravel or cobblestones, by volume.

Soil permeability is the ability of a soil to transmit air or water. The rates shown in table 5 are for the soils as they occur in place. The estimates were made by comparison with soils of known permeability and are shown as the range in which the soil normally will fall. The rates are helpful in determining potential use. Rapid permeability, for example, indicates that seepage losses at reservoir sites in the soil will be large. Very slow permeability, on the other hand, suggests the soil is likely to have a perched water table during a long rainy season or after excessive irrigation.

The available water capacity, expressed in inches per inch of soil depth, is the capacity of a soil to retain water that can be readily absorbed by plants. It is the estimated amount of moisture held in soil between field capacity and the permanent wilting point of plants.

The column showing reaction gives the estimated acidity or alkalinity of the soil expressed in pH value. A pH value of more than 7.3 indicates the soil is alkaline (basic), a pH value of less than 6.6 indicates an acid soil, and a pH value between 6.6 and 7.3 indicates a neutral soil.

Salinity of a soil is based on the electrical conductivity of saturated soil extract as expressed in millimhos per centimeter at 25° C. Salinity not only affects the suitability of a soil for production of crops, but it also affects the stability of a soil when used as construction material and its corrosiveness to other material.

Shrink-swell potential refers to the change in volume of the soil material that results from a change in content of moisture. It is estimated on the basis of the kind and amount of clay in the soil layers. In general, soils that have a high content of clay have high shrink-swell potential, and coarser textured soils that contain less clay have a low shrink-swell potential (fig. 7). The soil that contains the most clay generally shrinks and swells the most, but in some areas the kind of clay in the soil may be more important than the amount.

Three limitation ratings are used to interpret the soils: low, moderate, and high. Soil properties and qualities used to determine the classes are: percentage of clay, predominant clay mineral, coefficient of linear extensibility (COLE) in inches per inch, and shrinkage index.

Soils that have a rating of *low* do not have more than 18 percent montmorillonitic clay or more than 30 percent kaolinitic clay mineral; a COLE value of less than 0.03 inch per inch; and a shrinkage index of less than 5.0.

Soils that have a rating of *moderate* have 18 to 30 percent mixed or montmorillonitic clay minerals or more than 30 percent kaolinitic clay mineral; a COLE value of 0.03 to 0.06 inch per inch; and a shrinkage index of 5.0 to 7.0.

Soils that have a rating of *high* have more than 30 percent mixed or montmorillonitic clay minerals; a COLE

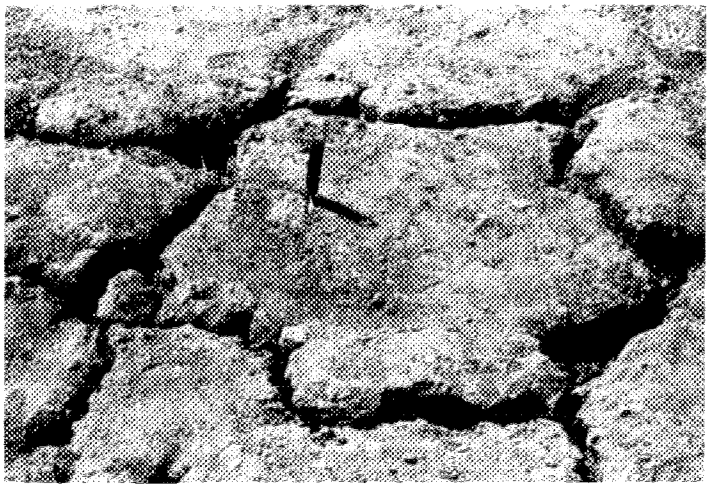

Figure 7.—**Cropley clay, 0 to 2 percent slopes, has high shrink-swell potential and the surface cracks when dry.**

value greater than 0.06 inch per inch; and a shrinkage index greater than 7.0.

Much damage to building foundations, roads, and other structures is caused by the shrinking and swelling of soils as they become dry or wet. Soils that have a low shrink-swell potential are suitable for building sites if other factors are favorable. As the shrink-swell potential increases, the soil becomes less suitable for buildings and roads. More detailed investigation of a site is needed where the soils have moderate or high shrink-swell potential. If large housing developments are placed on soils that have moderate or high shrink-swell potential, applying large amounts of water to lawns, shrubs, and other plants could cause land slippage. Land slippage is particularly a hazard on the steeper slopes.

Most materials used in construction, such as metal and concrete, corrode or deteriorate when buried in soil. The rate at which a material deteriorates depends largely upon the physical, chemical, and biological characteristics of the soil, and a given material corrodes more rapidly in some soils than in others. The corrosion probability generally is greater for extensive installations that intersect soil boundaries or soil horizons than for installations in one kind or soil or soil horizon. The range of characteristics between the layers in the profile of some soils is wide. As a result, the depth that a pipe or other structural material is buried can affect the degree of corrosion. A soil that has a more strongly developed subsoil, for example, has a different corrosivity rating for structural material laid near the surface than for such material laid just above or in the subsoil.

Construction of buildings and pavements, fill and compaction operations, adding material to the surface soil, and other measures that alter soil permeability increase the probability of corrosion. Mechanical agitation or excavation that results in nonuniform mixing of soil horizons is likely also to increase the probability of corrosion. In addition, corrosivity, particularly for steel pipes or other structures, is likely to be increased by electrical leaks from underground cables and by electrical charges resulting from the composition of dissimilar metals. Other factors likely to increase corrosivity are the quality of water used for watering plants, differences in the water content along conduits or structures, and the adding of fertilizer and large amounts of organic matter.

Several soil characteristics affect the rate of corrosion of untreated steel. The most important of these are (1) electrical resistance to flow of current, (2) total acidity, (3) soil drainage, and (4) soil texture.

The ratings for corrosivity in table 5 are based strictly on soil characteristics. Three ratings, low, moderate, and high, are used to interpret the soils. Soil properties and qualities used to determine the classes are drainage class and texture, total acidity, and conductivity of saturation extract (mmhos/cm. at 25° C).

Soils that have a rating of *low* are somewhat excessively or excessively drained and coarse textured, or well drained and medium textured. They have a total acidity of less that 8 milliequivalents of hydrogen ion per 100 grams of soil and a conductivity of the saturation extract of less than 1 millimho per centimeter.

Soils that have a rating of *moderate* are well drained and moderately fine textured, or moderately well drained and medium textured. They have a total acidity of 8 to 12 milliequivalents of hydrogen ion per 100 grams of soil and a conductivity of the saturation extract of 1 to 4.

Soils that have a rating of *high* are well drained, somewhat poorly drained, or poorly drained and fine textured. They have a total acidity of more than 12 milliequivalents of hydrogen ion per 100 grams of soil and a conductivity of the saturation extract greater than 4.

Engineering interpretations

Table 6 rates the suitability of soils for certain uses, such as topsoil, sand and gravel, and road fill. It also gives features affecting various engineering practices such as road location, reservoir sites, drainage and irrigation, and septic tank filter fields. Then it lists hydrologic soil groups. The features given for moderate and severe ratings are generally those that are unfavorable. They detract from the qualities needed for structure foundations or for soil material to be used in earthen structures. These features are caution signs when considering a soil for a specific use.

The ratings used for the soils as a source of topsoil, sand and gravel, and road fill are *good*, *fair*, *poor*, or *unsuitable*. Soil sampling is done to a depth of 5 feet.

Hydrologic soil groups are groupings of soils that yield similar amounts of runoff from a given storm. Soil characteristics such as infiltration rate, claypans, and depth are given consideration. The groups are based on runoff that occurs following a long-duration storm where there is no protection from vegetation.

Group A consists of soils having a high infiltration rate when thoroughly wetted. These soils are chiefly deep, well-drained to excessively drained sand or gravel. They have a high rate of water transmission and a low runoff potential.

Group B consists of soils having a moderate infiltration rate when thoroughly wetted. These soils are moderately deep to deep, moderately well drained to well drained and are moderately fine to moderately coarse textured. They have a moderate rate of water transmission.

Group C consists of soils having a slow infiltration rate when thoroughly wetted. These are soils that generally have a layer that impedes downward movement of water, or they are moderately fine textured to fine textured. They have a slow rate of water transmission.

Group D consists of soils having a very slow infiltration rate when thoroughly wetted. In this group are (1) clay soils that have high swelling potential, (2) soils that have a permanent high water table, (3) soils that have a claypan or clay layer at or near the surface, and (4) soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission and a high runoff potential.

The rating for road location relates to problems of road construction and maintenance. The entire soil profile when mixed is considered, except where the surface layer has a high organic-matter content. Among the soil features considered are depth to rock or to the water table, slope, and shrink-swell potential.

Water-retention structures refers to such structures as irrigation reservoirs, fish ponds, and stockwater ponds. Table 6 gives ratings for both earthfill embankments and the floor of the water-ponding area. Depth to the water table or to rock, and soil features such as stability, compressibility, and problems of piping and cracking are considered for embankments; permeability, slope, and depth to rock or to the water table are considered for the floor.

For agricultural drainage the factors considered are those features of the soil that affect the installation and performance of surface and subsurface drainage systems. Among these are drainage class, depth to rock or to the water table, and permeability.

Irrigation factors considered are features that affect suitability of soils for irrigation, such as available water holding capacity, intake rate, slope, and depth to rock. For soils not suited to irrigation, only the feature, or features, limiting their use is given.

Septic tank filter fields or absorption systems for onsite sewage disposal generally consist of a subsurface tile drain or a perforated pipe system installed to carry effluent or waste sewage water from the septic tank to the filter field, where it can percolate into the ground.

For rating the soil as a septic tank filter field, the terms *slight*, *moderate*, or *severe* are used. These ratings are based on such soil properties as permeability, depth to the water table, depth to rock or to the hardpan, drainage class, slope, and overflow hazard. The limiting properties are listed with the rating.

Formation and Classification of Soils

In this section, the factors that influence soil formation are discussed and the soils of the survey area are classified into higher categories.

Formation of Soils

Soil is a natural body on the surface of the earth in which plants grow. It is a mixture of rocks and minerals, organic matter, water, and air, all of which occur in varying proportions. The rocks and minerals are fragmented and partly or wholly weathered. Soils have more or less distinctive layers, or horizons, that are the product of environmental forces acting upon materials deposited or accumulated by geological agencies.

The characteristics of the soil at any given point are determined by the interaction of (1) the parent material; (2) the climate in which the soil material has accumulated and has existed since accumulation; (3) the relief, or topography, which influences the local, or internal, environment of the soil, its drainage, moisture content, aeration, susceptibility to erosion, and exposure to sun and wind; (4) biological forces that act upon the soil material, such as the plants and animals living on and in it, and (5) the length of time the climatic and biological forces have acted on the soil material.

Parent material

Parent material from which the soils in the Eastern Santa Clara Area have developed is both residual and alluvial.

The largest single geologic unit in the area of residual soils is included in the Franciscan-Knoxville Group of about Upper Jurassic age. Rocks include interbedded sandstone, shale, and chert that have undergone various degrees of metamorphism. Serpentine intrusions are also common. The sandstone, shale, and chert materials contain a high percentage of gravel and sand-sized particles that are mostly composed of quartz minerals. The sandy or gravelly soils, such as those of the Maymen and Parrish series, formed in this material.

Where serpentine rock has intruded, the soils are shallow to unweathered rock and the fertility is low. These soils have an unfavorable calcium-magnesium ratio.

Long, narrow strips of fine sediments occur on both sides of Santa Clara Valley. They consist of stratified or mixed sand, gravel, and clay that have calcium carbonate as the principal cementing agent. The soils that formed in this material are fine textured and generally have a calcareous subsoil. The Altamont, Diablo, and Azule soils are typical of this group of soils.

Alluvial parent material is generally of local origin. It is washed from geologic formations of the uplands that surround the valley. Because of the wide variety of sedimentary, metamorphic, and igneous rock formations in the uplands, the alluvium is mixed.

Alluvial materials differ in texture mainly because they were deposited in different ways. Alluvium on fans and toe slopes generally has a texture and other characteristics similar to those of the material in the hills immediately above it. For example, Cropley clays developed on fans in material that had been washed down from upland areas of the Diablo and Altamont soils. Recent alluvium in the Santa Clara Valley has been laid down by flooding streams. As the streams overflowed their channels and the water spread over the flood plain, sediments were deposited. When the floodwaters spread, they moved more slowly, and silt mixed with some sand and clay was deposited. Most of the clay particles were deposited when the flood passed, and the water was left standing in the lowest part of the valley south of Gilroy.

An earlier cycle of deposition, when streams had different courses, is suggested by the many alluvial soils that have buried horizons at a depth of 40 to 80 inches, by some clayey soils that are underlain by sand at a depth of 40 to 80 inches, and by some loamy soils that have clay layers at a depth of 60 to 100 inches. Geologic changes, not stream meandering, are believed to have caused the streams to change their course and begin a new cycle of erosion and deposition.

Differences in texture of the alluvium are generally accompanied by differences in chemical and mineralogical composition. The sandier sediments generally contain more quartz and less feldspar and ferromagnesian minerals than do the finer textured sediments. The finer textured alluvium generally contains a high percentage of montmorillonitic clay minerals and more exchangeable sodium.

Climate

Climate functions directly in the accumulation of soil parent material and in the differentiation of horizons of the soils in the Eastern Santa Clara Area. Temperature and rainfall govern rates of weathering of rocks and the decomposition of minerals. They also influence leaching, eluviation, and illuviation. Presumably, the climate in the survey area is similar to the climate under which the soils formed. It is generally a subhumid, mesothermal climate that is characterized by cool, moist winters and hot, dry summers.

Differences in annual rainfall and temperature are associated with changes in elevation on both sides of the Santa Clara Valley. The greatest amount of precipitation is in the Santa Cruz Mountains, where the seasonal average is 50 inches or more at some points. Average annual rainfall in the Gilroy area and most of the Diablo Range generally is 16 to 25 inches, but at higher elevations it is 25 to 30 inches. The southern part of Santa Clara Valley is warmest, with an average annual temperature of 60° F. at Gilroy. Average annual temperature in the Santa Cruz Mountains is 56° to 57°, and the coolest area is Mt. Hamilton, where the average annual temperature is 54°.

Organic-matter content is highest in the soils at the higher elevations, where the rainfall is highest, the temperature is cool, vegetation is abundant, the plants have fairly coarse roots, and much plant residue is returned to the soil. The cooler temperatures, however, do not favor rapid decomposition. Rainfall is sufficient to leach the soils of carbonates and other water-soluble materials. As a result, soils such as those of the Los Gatos series have a dark A horizon and a weak textural Bt horizon that is medium acid.

The effects of climatic changes on soils formed from similar parent material are evident in the soils of the Gaviota series. These soils formed in the areas of lower rainfall on the warmer south slopes. There the warmer climate has affected the rate at which water is lost through evaporation. Scarcity of water slows the weathering of rock, and less moisture means fewer kinds of plants can grow. Also, all carbonates have not leached out of the solum. Therefore, the Gaviota soils are shallow, have less organic matter, and are slightly acid in reaction.

Relief

The relief of the Eastern Santa Clara Area was mostly determined by the past geologic history. The area is in three prominent physiographic units: the Santa Cruz Mountains, the Diablo Range, and the Santa Clara Valley. Relief influences the formation of soils in the Eastern Santa Clara Area through its effects on drainage, erosion, air drainage, and variation in exposure to the sun and wind.

The Santa Cruz Mountains and Diablo Range are deeply dissected by drainageways. This dissection has formed long, winding ridges that have relatively steep side slopes. Some of the ridgetops are broad and have slopes ranging from 10 to 25 percent. Other ridgetops are narrow, are somewhat angular, and have slopes greater than 25 percent. Because of the steep and very steep slopes, most of the soils are well drained to somewhat excessively drained. Geologic erosion is active, and accelerated erosion has followed overgrazing, fires, and cultivation. Consequently, a thick soil profile seldom develops. Examples of shallow, steep and very steep soils are those of the Gaviota, Vallecitos, and Parrish series.

Variations in rainfall, caused largely by relief, are pronounced over short distances. For example, annual rainfall varies from 16 to 50 inches within a distance of 10 miles. Soils such as those of the Gaviota series lie in areas of low rainfall. These soils have been very slightly weathered and partially leached of carbonates. The shortage of moisture, which restricts weathering and leaching, also limits plant growth and leaves the soils with less than 1 percent organic matter. Soils such as those of the Los Gatos series in the areas of higher rainfall and on north-facing slopes receive less direct sunlight, have cooler soil temperatures, and retain moisture longer. These soils have more organic matter accumulated in the uppermost layer because vegetation is abundant, plants have fairly coarse roots, and much plant residue has been returned to the soil. Carbonates generally have been leached out of the solum, and reaction is medium acid.

The flood plains of the Santa Clara Valley are relatively flat and have slopes that are less than 2 percent. Along drainageways and on alluvial fans, slopes range up to 9 percent. Because of the level topography southeast of Gilroy, drainage is poor and drainage outlets are lacking. This causes a high or fluctuating water table and a concentration of exchangeable sodium. The Pacheco and Clear Lake soils formed in this low-lying, poorly drained area under salt-tolerant and water-tolerant plants. Because these soils have poor drainage, they have underlying horizons that indicate intense reduction of iron. This is evidenced by the presence of olive-brown, brown, and yellowish-brown mottles. The Yolo and Garretson soils formed on the well-drained alluvial fans and alluvial plains. These soils lack mottles, segregated lime, and gypsum.

Biological activity

After the accumulation of soil parent material, plants, worms, bacteria, and fungi begin to grow and die. At this stage organic matter tends to accumulate on and in the surface layer. Accumulation of organic matter has been an important process in horizon differentiation of the soils in the Eastern Santa Clara Area.

Upland soils on north slopes are protected from direct sunlight. They support a fairly dense canopy of various broadleaf plants and hardwood trees. These plants provide shade and cover that reduce runoff and erosion. Also, because the vegetation adds humus, organic-matter content may be as much as 5 percent. This has influenced the dark color, structure, and physical condition of the Los Gatos, Felton, and Ben Lomond soils. In contrast, the vegetation on the south slopes is grass and oak trees or brush. This cover provides little shade, and the soils are dry for longer periods of time, which creates an undersirable habitat for micro-organisms. As a result, geologic erosion is active and organic-matter content is less than 1 percent. The Gaviota and Maymen soils occur on these exposed slopes.

In the Santa Clara Valley, the well-drained alluvial soils such as those of the Garretson and Yolo series developed under annual grasses, scattered brush, and scattered large oaks. In these soils the accumulation of organic matter has been the most important process in horizon differentiation. The formation of distinct horizons, however, has been slowed down by burrowing animals and earthworms that have been actively loosening and mixing the soil material.

The poorly drained soils of the flood plains have developed under grasses that require plenty of water and under other aquatic plants. While these soils were forming drainage was poor, water was readily available, and the native plants grew abundantly. Consequently, these soils are the darkest in the Santa Clara Valley. Most of them have an organic-matter content of more than 2 percent, and they provide a good habitat for micro-organisms. The Pacheco, Clear Lake, and Sunnyvale soils are examples of these soils.

Time

Time is required for soil formation, which proceeds in stages, none of which is distinct. It is not possible to be sure where one stage in soil formation ends and another begins. Thinking of soil formation as being in stages, however, is simply a way of looking at the continuous process one part at a time. In the Eastern Santa Clara Area, stages of these processes are expressed by the horizon differentiation within each soil.

In general, soils on the alluvial fans and alluvial plains are young. Soils such as those of the Yolo and Garretson series have developed in the unconsolidated sediments only in the time that has elapsed since the last sediments were laid down. These soils have been influenced enough by soil-forming processes to have a thin A horizon and some leaching of carbonates.

Rincon and Hillgate soils are on the old fans and terraces. These are the oldest and most strongly developed soils in the survey area. They have had time for translocation of silicate clay minerals, which is indicated by the abrupt change in texture from the A horizon to the B2t horizon.

Soils in the mountains and foothills differ somewhat in degree of development. Young soils such as those of the Gaviota series have steep and very steep slopes. They are shallow to bedrock and have a thin A horizon, because for soils in this position soil material is removed by geologic erosion nearly as fast as it forms. San Benito soils, on the other hand, are young, are less susceptible to erosion, and have had enough time for the accumulation of organic matter in the surface layer and for some leaching of carbonates. Los Gatos and Vallecitos soils are intermediate in age and have had time for some translocation of silicate clay minerals. This is indicated by changes in color, structure, and consistence of the B2t horizon.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationships to one another and to the whole environment, and to develop principles that help us to understand their behavior and response to manipulation.

Thus, in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and applied in managing farms, fields, and woodlands; in developing rural areas; in engineering works; and in many other ways. They are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The current system was adapted for general use by the National Cooperative Soil Survey in 1965 (*11*). The system is under continual study, and readers interested in the latest developments in this system should consult the latest literature available (*8*).

In table 7 the soil series of the Eastern Santa Clara Area are placed in some categories of the current system of classification. The classes in the current system are briefly discussed in the following paragraphs. After this the soil orders represented in the Eastern Santa Clara Area are discussed.

ORDER: Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions, Entisols and Histosols, occur in many different climates.

SUBORDER: Each order is subdivided into suborders, primarily on the basis of soil characteristics that seem to produce classes having the greatest genetic similarity. The suborders have a narrower climatic range than the orders. The criteria for suborders chiefly reflect the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

GREAT GROUP: Each suborder is divided into great groups according to the presence or absence of genetic horizons and the arrangement of these horizons.

SUBGROUP: Each great group is subdivided into subgroups. One of the subgroups represents the central (typic) segment of the great group, and the others, called intergrades, contain those soils having properties of soils in another group, suborder, or order.

FAMILY: Each subgroup is divided into families, primarily on the basis of properties important to the growth of plants. Among the properties considered are texture, mineralogy, reaction, soil temperature, and thickness of horizons.

SERIES: The series consists of a group of soils that formed from a particular kind of parent material and have genetic horizons that, except for texture of the surface soils, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, consistence, reaction, and mineralogical and chemical composition.

New soil series must be established and concepts of some established series, especially older ones that have been used little in recent years, must be revised in the course of the soil survey program across the country. A proposed new series has tentative status until review of the series concept at the State, regional, and national levels of responsibility for soil classification results in a judgment that the new series should be established. Most of the soil series described in this publication have been established earlier.

TABLE 7.—*Classification of soils*

Series	Family	Subgroup
Altamont	Fine, montmorillonitic, thermic	Typic Chromoxererts.
Arbuckle	Fine-loamy, mixed, thermic	Typic Haploxeralfs.
Azule	Fine, montmorillonitic, thermic	Mollic Haploxeralfs.
Ben Lomond	Coarse-loamy, mixed, mesic	Cumulic Ultic Haploxerolls.
Campbell	Fine-silty, mixed, nonacid, thermic	Aquic Xerorthents.
Clear Lake	Fine, montmorillonitic, thermic	Typic Pelloxererts.
Climara	Fine, montmorillonitic, thermic	Chromic Pelloxererts.
Cortina	Loamy-skeletal, mixed, nonacid, thermic	Typic Xerofluvents.
Cropley	Fine, montmorillonitic, thermic	Chromic Pelloxererts.
Diablo	Fine, montmorillonitic, thermic	Chromic Pelloxererts.
Esparto	Fine-loamy, mixed, thermic	Typic Haploxeralfs.
Felton	Fine-loamy, mixed, mesic	Ultic Argixerolls.
Garretson	Fine-loamy, mixed, nonacid, thermic	Typic Xerorthents.
Gaviota	Loamy, mixed, nonacid, thermic	Lithic Xerorthents.
Gilroy	Fine-loamy, mixed, thermic	Typic Argixerolls.
Henneke	Clayey-skeletal, serpentinitic, thermic	Lithic Argixerolls.
Hillgate	Fine, montmorillonitic, thermic	Typic Palexeralfs.
Inks	Loamy-skeletal, mixed, thermic	Lithic Argixerolls.
Keefers	Clayey-skeletal, montmorillonitic, thermic	Mollic Haploxeralfs.
Los Gatos	Fine-loamy, mixed, mesic	Typic Argixerolls.
Los Osos	Fine, montmorillonitic, thermic	Typic Argixerolls.
Los Robles	Fine-loamy, mixed, thermic	Mollic Haploxeralfs.
Madonna	Fine-loamy, mixed, mesic	Dystric Xerochrepts.
Maxwell	Fine, montmorillonitic, thermic	Typic Pelloxererts.
Maymen	Loamy, mixed, mesic	Dystric Lithic Xerochrepts.
Montara	Loamy, serpentinitic, thermic	Lithic Haploxerolls.
Pacheco	Fine-loamy, mixed, thermic	Aquic Haploxerolls.
Parrish	Fine, vermiculitic, mesic	Ultic Haploxeralfs.
Pleasanton	Fine-loamy, mixed, thermic	Mollic Haploxeralfs.
Rincon	Fine, montmorillonitic, thermic	Mollic Haploxeralfs.
San Andreas	Coarse-loamy, mixed, thermic	Typic Haploxerolls.
San Benito	Fine-loamy, mixed, thermic	Pachic Haploxerolls.
Santa Lucia [1]	Clayey-skeletal, mixed, thermic	Ultic Haploxerolls.
San Ysidro	Fine, montmorillonitic, thermic	Typic Palexeralfs.
San Ysidro, acid variant	Fine, montmorillonitic, thermic	Aquultic Haploxeralfs.
Sunnyvale	Fine, montmorillonitic, thermic	Typic Calciaquolls.
Vallecitos	Clayey, montmorillonitic, thermic	Ruptic-Entic Lithic Mollic Haploxeralfs.
Willows	Fine, montmorillonitic, thermic	Typic Pelloxererts.
Yolo	Fine-silty, mixed, nonacid, thermic	Typic Xerorthents.
Zamora	Fine-silty, mixed, thermic	Mollic Haploxeralfs.

[1] This series is a taxadjunct because the dark colors are not so deep in the profile as in the Santa Lucia series elsewhere.

SOIL ORDERS IN THE AREA

The soil orders in the Eastern Santa Clara Area are Alfisols, Entisols, Inceptisols, Mollisols, and Vertisols.

Alfisols.—Soils in this order have been in place a sufficient amount of time to have developed horizons of clay accumulation. These soils are on old alluvial fans, terraces, and uplands. Their A horizon is mainly hard or very hard and massive when the soils are dry. Thickness of the profile ranges from less than 1½ feet where the soils are underlain by hard rock to more than 5 feet where the parent material is unconsolidated. Clay mineralogy of the finer textured soils is dominantly montmorillonitic clay, but the others have mixed mineralogy. Average annual rainfall on these soils is between 16 and 30 inches, and the average annual air temperature is about 58° F. Relief is nearly level to very steep.

Natural vegetation on these soils consists of perennial and annual grasses, forbs, and scattered oak trees. These plants add ample organic matter to the soils, but because of the warm, moist weather in spring and the hot, dry weather in summer, oxidation is rapid. As a result, the organic-matter content of the surface layer is generally low. The weakness or lack of structure and light colors of these soils are mainly related to low organic-matter content.

Twelve series are in this order: Arbuckle, Esparto, San Ysidro, Azule, Keefers, Los Robles, Pleasanton, Rincon, Parrish, Hillgate, Vallecitos, and Zamora. These soils have been placed into the Xeralf suborder. They are classified in several subgroups.

The Esparto and Arbuckle soils are typical of the Xeralf suborder. They have a pale surface horizon and a reddish argillic horizon. The content of organic carbon is low. There is only a slight clay increase in their Bt horizon because of their relatively young age. These are very deep alluvial soils that have slopes of 0 to 9 percent. Esparto soils developed under moderately well drained conditions. Arbuckle soils are well drained.

Azule, Keefers, Los Robles, Pleasanton, Rincon, and Zamora are classified as Mollic intergrades. The soils are similar to those of typical Xeralf suborder soils, but they have a darker A1 horizon that contains slightly more organic matter; however, they are massive and hard when dry.

Azule and Rincon soils have a dark grayish-brown and dark-gray A horizon. Azule soils have brown, medium acid gravelly sandy clay argillic horizons, are strongly sloping to very steep, and developed on uplands. Rincon soils have grayish-brown, mildly alkaline gravelly clay argillic horizons, are nearly level to moderately sloping, and developed on alluvial fans.

Los Robles and Pleasanton soils are nearly level to strongly sloping and developed on alluvial fans. Los Robles soils have a dark-brown, neutral clay loam A horizon and similarly colored, neutral gravelly clay loam argillic horizons that developed in basic igneous alluvium. Pleasanton soils have a grayish-brown, slightly acid loam A horizon and brown, neutral gravelly clay loam argillic horizons that developed in sedimentary alluvium.

Zamora soils have a dark grayish-brown, neutral clay loam A horizon and dark-brown, neutral, weakly developed clay loam argillic horizons that developed in sedimentary alluvium.

Hillgate, San Ysidro, and San Ysidro, acid variant, soils are more strongly developed than other soils of this suborder. The surface horizon is pale brown to light brownish gray. It is low in content of organic carbon. Moist color values are 4 or more, and dry values are more than one unit higher. Organic-matter content is less than 1.2 percent. The boundary of the A and B horizons is abrupt (has a clay increase of 20 percent or more within 1 inch). The argillic horizons are massive or have prismatic structure and are clay in texture. The dominant clay mineral is montmorillonite.

San Ysidro soils differ from Hillgate soils by having mottles with a chroma of 3 or more within 18 inches of the surface; also, a thin, bleached A2 horizon is present just above the argillic horizon. Except for being strongly acid in the B and C horizons (less than 75 percent base saturation), San Ysidro soils, acid variant, are similar to San Yisdro soils.

Parrish soils have a reddish-brown, medium acid gravelly clay loam A horizon and a reddish-brown, strongly acid gravelly clay Bt horizon. These soils differ from other soils in this group by having less than 75 percent base saturation in some part of the Bt horizon.

Vallecitos soils have a brown, medium acid loam A horizon and a reddish-brown, medium acid clay Bt horizon. These soils differ from other soils in this group by having metamorphosed shale bedrock at a depth of 19 to 30 inches.

Entisols.—Soils placed in this order either lack distinctive horizons, either surface or subsurface, or have only the beginning of horizons. Included in this order are very deep alluvial soils that are mostly well drained and nearly level to gently sloping. There are some with substratum materials that are mottled from somewhat poor drainage and are nearly level. Also included with this group are shallow upland soils on hard sandstone. Slopes range from 5 to 75 percent, and drainage is good to somewhat excessive.

Accumulations of calcium carbonate occur in some of these soils, but not enough to be distinctive. Differences in chemical and mineralogical composition generally accompany differences in texture. The finer textured sediments are high in content of montmorillonitic clay minerals, and others have mixed mineralogy. Elevation ranges from 100 to 4,000 feet. Average annual rainfall is 15 to 50 inches, and the average annual air temperature is 55° to 60° F. Natural vegetation is abundant, and the soils developed under a cover of grasses, woodland, and brush. The plants have fairly coarse roots, and much plant residue is returned to the soil. Decomposition of plant residue is rapid, but the soils retain only low to moderate amounts of organic matter as a result of the oxidation that results from high temperatures.

Five soil series are in this order: Campbell, Cortina, Garretson, Gaviota, and Yolo. These soils are in the Orthent or Fluvent suborders.

Yolo soils are typical of this group. They have a grayish-brown, massive loam or silty clay loam A horizon and a brown, massive silt loam or silty clay loam C horizon. Calcium is the dominant exchangeable cation, and the base saturation is high. Campbell soils differ from Yolo soils by having developed under conditions of poorer drainage and by having a mottled C horizon. Garretson soils have a loamy C horizon. Cortina soils are low in organic-matter content and have a very gravelly C horizon. Gaviota soils are less than 20 inches deep to bedrock, are moderately steep to very steep, have low organic-matter content, and are on uplands.

Inceptisols.—Soils placed in this order have horizons that show alteration but lack extreme weathering. Soils in this group formed on weathered acid sandstone and shale in the Santa Cruz Mountains where the average annual rainfall is 30 to 50 inches. Carbonates have been removed by leaching. Natural vegetation is mainly annual grasses, forests, and shrubs. Average annual air temperature is 55° to 56° F. Elevation ranges from 1,500 to 4,000 feet.

Madonna and Maymen are the two soil series in this order. These soils are placed in the Ochrept suborder. All parts of these soils are dry for 60 or more consecutive days in 7 out of 10 years. Base saturation is less than 60 percent in some parts of the soils. The A1 horizon is light colored. These soils have slopes of 15 to 75 percent and are well drained and somewhat excessively drained. Erosion is active.

Mollisols.—Soils placed in this order have developed in areas where the moisture and temperature favored the accumulation of organic matter. As a result, the surface layer of these soils is dark colored and has an organic-matter content as high as 5 percent. These soils have a soft or slightly hard (when dry) A horizon and a moderate or strong structure.

Fourteen series included in this order are: Ben Lomond, Felton, Gilroy, Henneke, Inks, Los Gatos, Los Osos, Montara, Pacheco, San Andreas, San Benito, Santa Lucia, and Sunnyvale. These soils are placed in either the Aquoll or the Xeroll suborder.

Soils on the valley floor that have developed under poor drainage are classified as Aquolls. The Xeroll suborder is divided into soils with horizons of clay accumulation (Bt horizon), called Argixerolls, and soils without a Bt horizon but with horizons having evidence of alteration (B horizon), called Haploxerolls. These soils are further grouped at the family level by differences in textural class, soil temperature, and mineralogy.

Sunnyvale soils are in the Calciaquoll group. They are calcareous, granular silty clay in the A horizon and gleyed, calcareous silty clay in the lower part of the C horizon.

These soils developed under conditions of poor drainage and ground water that contained calcium bicarbonates. The capillary rise and evaporation, plus transpiration, caused the precipitation of lime.

Los Gatos, Los Osos, Gilroy, Inks, Henneke, and Felton soils are in the Argixeroll group. Soils in this group are dry throughout the profile for 60 consecutive days or more for 7 years out of 10. These soils differ mainly in the amount of clay in the Bt horizon, depth, mineralogy, and average annual soil temperature.

Los Gatos soils are typical of this group and have a brown, slightly acid gravelly loam A horizon and a reddish-brown, medium acid gravelly clay loam Bt horizon. They are moderately steep to very steep and developed on uplands over metamorphosed shale rock. Average annual soil temperature is 56° F.

Gilroy soils differ by having developed on basic igneous rock. Average annual soil temperature is more than 58°.

Los Osos soils differ by having a clay Bt horizon and an average annual soil temperature of more than 58°.

Inks soils have a lithic contact with basic igneous bedrock at a depth of 12 to 19 inches and an average annual soil temperature of more than 58°.

Henneke soils have a very gravelly clay Bt horizon and developed on serpentine rock; average annual soil temperature is more than 58°.

Felton soils are similar to Los Gatos soils in many respects, except they have a base saturation of more than 35 percent but less than 75 percent.

San Andreas, Santa Lucia, Montara, San Benito, Ben Lomond, and Pacheco soils are in the Haploxeroll group. Soils in this group are similar to the Argixerolls, except that they have altered horizons but lack a B horizon. They differ from one another in textural class, depth, mineralogy, drainage, and average annual soil temperature.

San Andreas soils are typical of this group and have a grayish-brown, granular, soft, medium acid fine sandy loam A horizon over soft sandstone at an average depth of 22 to 30 inches. These soils are moderately steep to very steep and developed on uplands. Average annual soil temperature is more than 58°.

Santa Lucia soils differ by having a gray shaly and very shaly clay loam profile developed on shale rock.

Montara soils differ by having a dark-gray clay loam A horizon and serpentine bedrock at a depth of less than 16 inches.

San Benito soils have a limy horizon developed on soft sandstone and shale.

Ben Lomond soils are similar in many respects, except they have a base saturation of more than 50 percent but less than 75 percent.

Pacheco soils have slopes of less than 2 percent and developed in sedimentary alluvium under more poorly drained conditions than exist today. They have mottles within 16 inches of the surface, and their organic-matter content decreases with depth.

Vertisols.—Soils placed in this order shrink during the dry season as they lose moisture, and they develop wide cracks. These soils swell during the winter wet season, and cracks in them close. Because of this shrink-swell characteristic, material from the upper horizons falls into cracks in the lower horizons, which mixes and churns the soil and offsets horizon differentiation. Texture is typically clay, and the dominant clay mineral is montmorillonite. The dark, thick A horizon and the strong structure of these soils are a result of their high organic-matter content. In the exchange complex of these soils, calcium and magnesium are dominant. The soils developed under grasses, shrubs, or mixed shrubs, grasses, and scattered oak trees. Average annual rainfall is 16 to 25 inches. Average annual air temperature is 58° to 60° F.

Soils in this order are in the Xerert suborder. These soils are in the Altamont, Clear Lake, Cropley, Climara, Diablo, Maxwell, and Willows series. The main differences among soils in this suborder are relief, drainage, color, and parent material.

The Diablo soils are typical of this suborder. These soils consist of dark-gray clay, have a thick A horizon, and are calcareous in the C horizon. In more than 7 years out of 10, cracks open and close once each year and remain open for 60 consecutive days or more. The Diablo soils are strongly sloping to steep and developed from soft, calcareous sandstone and shale on uplands.

Altamont soils are similar to the Diablo soils but have a color value of less than 3.5 when moist and 5.5 when dry throughout the upper 12 inches.

The Climara soils differ by having developed in metamorphosed basic igneous rock, but the Cropley soils are nearly level to moderately sloping and developed in mixed alluvium on fans.

Maxwell soils are moderately well drained, are nearly level to moderately sloping, and developed in serpentine alluvium on fans.

Clear Lake soils are level and developed under poor drainage on low flood plains. Willows soils have a chroma when moist of more than 1.5, are level and poorly drained, and developed on low flood plains; free gypsum crystals are present in their C horizon.

General Nature of the Area

This section briefly describes the history, physiography, geology, and climate of the Eastern Santa Clara Area. Then it discusses the water supply, industry and farming, population, community facilities, transportation, and vegetation.

History

The Spanish first explored the Santa Clara Valley in 1769, and in 1777 they established the first settlement at what is now San Jose (*7*). For the first 100 years, growth was very slow. The economy was based on herds of sheep and cattle. Hides and tallow were the only products of significance, and these had to be shipped to San Francisco through a port at Alviso. Trade was therefore limited by the difficulties of access.

In 1870 the coast route of the Southern Pacific Railroad was constructed through the valley. This gave considerable impetus to more intensive farming, which forced cattle raising into the foothills. Wheat farming gradually replaced cattle raising in the valley until, in 1880, the area from San Jose to Gilroy formed an almost unbroken wheat field.

Since 1880 grain farming has decreased and fruit raising has increased. Orchards, predominantly of French prunes, and vineyards were established on most of the tillable land.

At the present time, the valley floor from the vicinity of Gilroy northward is almost entirely planted to deciduous fruits and grapes. Canning became the first major industry.

The dominance of farming and associated industries continued through the first half of the present century. As recently as 1940, 23 percent of the workers in the county earned their living directly from the products of the soil, either in the fields or in the food processing plants, while many others provided services for these workers.

Since 1950 the dependence on farming has lessened. There has been an increasing number of factories that produce a variety of goods in no way related to farming. By 1962, 25 percent of all workers in the county were engaged in the manufacture of durable goods. Farming and food processing, which were once the principal economic enterprises of the county, now support fewer than 9 percent of the county work force.

Physiography

The Eastern Santa Clara Area consists of the southern part of the Santa Clara Valley, which extends through the central part of the area, and of the rolling hills and mountainous uplands on either side of the valley.

The uplands in the western part of the area are the Santa Cruz Mountains, which consist of a number of complex ridges or small ranges with rugged slopes that range in gradient from 40 to 60 percent or more. The crest of these mountains is generally at an elevation of about 2,000 to 3,400 feet. The highest point, Loma Prieta Peak, about a mile east of the ridge line, has an elevation of 3,806 feet.

The uplands in the eastern part of the area are in the Diablo Range, which separates the Santa Clara Valley from the San Joaquin Valley. This range consists of several parallel ridges having slopes of 20 to 60 percent and of small, intervening valleys. Copernicus Peak, near the Lick Observatory at Mt. Hamilton, and the highest point in the survey area, is 4,372 feet in elevation. The foothills of this range have smoother, less steep slopes that generally range from 20 to 40 percent. The crests of these foothills range from 1,000 feet to slightly more than 2,000 feet in elevation.

Upland areas of undulating to rolling relief on eroded terraces are, in many places, at the base of the mountains and hills on both sides of the valley. The slopes of these areas are from 5 to 35 percent, and elevation ranges from 250 to 1,000 feet.

The lowland, or valley floor, consists chiefly of a number of confluent alluvial fans and flood plains formed by deposits from the numerous streams that enter the valley from both mountain systems. The valley extends northwest and southeast through the central part of the area. The comparatively smooth floor of the valley ranges in elevation from 100 to 400 feet. An imperceptible alluvial divide at Morgan Hill separates the drainage of the valley into a north-flowing system and a south-flowing system. The former drains into San Francisco Bay at the north end of Santa Clara County, and the latter leads to the Pajaro River south of Gilroy and eventually flows into Monterey Bay. The regional drainage of the valley is generally well developed. Areas of poorly drained soils occur, and the most important of these are south and west of Old Gilroy.

Geology

The oldest rocks found within the limits of the Eastern Santa Clara Area are included in the Franciscan-Knoxville Group of Upper Jurassic age. These rocks form the largest single geologic unit in the area. Overlying the Jurassic rocks locally are marine sedimentary rocks of Cretaceous age. Bordering the San Andreas fault, and in isolated patches in the Diablo Range, Miocene beds occur. Along the margins of the Santa Clara Valley, Pliocene strata are exposed and the valley floor itself is composed of an accumulation of Quaternary clay, sand, and gravel. Tertiary volcanic rocks are scarce, and in the few isolated areas they occur only in small, local bodies.

The structure of the area is complex. It is controlled by faulting, the trend of which is predominantly in a northwesterly direction, which is characteristic of the general structural trend of California. In many places, folding and crumbling of the sediments are associated with faulting. The most notable faults in the area, which are also the major features of the Central Coast Ranges, are the San Andreas, Hayward, and Calaveras faults. Other prominent related faults of lesser extent are the Sargent, Silver Creek, and Madrone Springs faults.

The San Andreas fault, together with one of its prominent branches, the Sargent fault, subparallels the western boundary of Santa Clara County and separates Miocene strata from Upper Jurassic rocks. The Calaveras and Hayward faults are nearly parallel to each other on the western side of the Diablo Range. The three major fault systems are predominantly of the strike-slip type, with probable large right lateral displacements (east blocks moved relatively south). Two important faults branching off the Calaveras fault are the Madrone Springs and the Silver Creek faults.

Numerous northwest-trending folds in the Tertiary beds have been mapped. Folding within areas of Upper Jurassic rocks, however, is not so well known, because persistent axes cannot be traced with certainty.

Climate [6]

Santa Clara County has moderate temperatures and light to heavy precipitation (*2*). Temperature ranges from around 10° F. in winter to well above 100° in summer. Average low temperatures in winter are in the middle thirties (table 8). Temperatures of 32° or lower occur in most years over much of the area (table 9); however, the growing season still ranges from 200 to 275 days. As a result of the mild temperatures, the value for heating degree-days ranges from 2,500 to 4,500 units.

The moderating influence of the Pacific Ocean, to the west, is felt in the relatively uniform temperatures that are characteristic of the northern part of the Santa Clara Valley. Offshore circulation patterns only infrequently permit continental temperatures to establish themselves, and these occasions are usually only 2 or 3 days in dura-

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[6] By C. Robert Elford, climatologist for California, and John Estills, assistant climatologist for California, National Weather Service, U.S. Department of Commerce.

TABLE 8.—*Temperature and precipitation data, San Jose, Calif.*

Month	Temperature				Precipitation		
	Average daily maximum	Average daily minimum	2 years in 10 will have at least 4 days with—		Average monthly total	1 year in 10 will have—	
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—
	° F. (1)	° F. (1)	° F. (2)	° F. (2)	*Inches* (1)	*Inches* (1)	*Inches* (1)
January	58	41	65	33	2. 7	0. 4	4. 7
February	61	43	70	35	2. 6	. 8	5. 7
March	65	45	78	37	1. 9	. 1	4. 6
April	69	47	84	39	1. 1	. 2	3. 2
May	73	50	89	44	. 4	0	1. 2
June	78	53	95	48	. 1	0	. 2
July	81	55	91	51	(3)	0	(3)
August	80	55	90	51	(3)	0	. 1
September	80	55	93	49	. 1	0	. 3
October	74	51	88	45	. 6	0	1. 3
November	66	45	78	38	1. 1	0	2. 8
December	59	42	68	34	2. 6	. 6	5. 0
Year	70	48	[4] 100	[5] 31	13. 2	9. 3	18. 4

[1] Period of record: 1931–60.
[2] Period of record: 1951–60.
[3] Trace.
[4] Average highest annual maximum.
[5] Average lowest annual minimum.

tion. In the mountainous areas, the temperatures sometimes vary considerably within short distances.

During the summer, the cool temperature and the prevailing, moderate to strong, west and northwest offshore winds move into the San Francisco Bay area at low elevations; thus, the effect of the marine air is felt in the Santa Clara Valley mainly late in the afternoon and in the evening. Higher elevations are often above this layer of marine air, and its influence is diminished there.

Along the eastern edge of the survey area, on the east slope of the Diablo Range, the weather resembles that of the San Joaquin Valley. As a result, temperatures are warmer in summer and cooler in winter. Precipitation averages only 16 inches in parts of the Santa Clara Valley, but over the mountains to the east it is as much as 30 inches.

TABLE 9.—*Probabilities of last freezing temperatures in spring and first in fall, San Jose, Calif.*

Probability	Dates for given probability and temperature [1]		
	24° F. or lower	28° F. or lower	32° F. or lower
Spring:			
1 year in 10 later than	(2)	February 4	February 20
2 years in 10 later than	(2)	January 13	February 12
5 years in 10 later than	(2)	(2)	(2)
Fall:			
1 year in 10 earlier than	(3)	(3)	November 19
2 years in 10 earlier than	(3)	(3)	December 2
5 years in 10 earlier than	(3)	(3)	December 28

[1] Period of record: 1931–60.
[2] Earlier than January 1.
[3] Later than December 31.

Annual evapotranspiration ranges from 25 to 30 inches, but in dryfarmed areas it is only 6 to 10 inches during the growing season. Range grasses dry out during June in a typical year. Pan evaporation amounts to 55 to 60 inches per year; about two-thirds of it occurs during the May–October period.

In summer, cloudiness tends to blanket the valley at night, while the east slope of the Diablo Range remains clear. The orientation of the mountain chain results in a predominantly northwesterly flow of air in the Santa Clara Valley in summer and a southeasterly flow in winter. Mountain tops are subject to greater variability in wind direction in response to changing weather, particularly in winter. In the mountain valleys, wind patterns are influenced by local terrain.

In summer there is a moderate flow of marine air through the lower passes of the mountains. These winds frequently reach speeds of 20 miles per hour or more. The same pattern is also responsible for the light to moderate winds from the northwest that blow up the Santa Clara Valley on summer afternoons, except in its southern extremity, where this flow is countered by the northward spread of the marine air that enters through the Pajaro River Valley.

In winter, winds are predominantly southerly and are strongest at higher elevations. It is estimated that winds reach speeds of 30 miles per hour every other year, on the average, and as much as 80 miles per hour once in 50 years. These figures are based on an assumed average exposure, and some promontories and peaks probably receive considerably more wind than this.

Total annual sunshine is about 3,100 hours in the Santa Clara Valley and 3,300 hours in the eastern part of Santa Clara County. This represents 65 percent and 70 percent, respectively, of the total possible annual sunshine. The percentage of sunshine received (50 to 55 percent) is generally uniform over the survey area in winter, but in summer the percentage of sunshine received ranges from around 70 percent in the Santa Clara Valley to 90 percent or more along the eastern boundary of Santa Clara County.

Humidity is relatively high during the entire year along the coast and during the winter over inland areas. Humidity over inland areas late in summer and in fall, however, is moderate to low.

Water Supply

Ground water basins are the chief source of water in Santa Clara County (*5, 6*). Since farms, municipal areas, and industry are dependent upon an adequate water supply, the importance of ground water basin reserves cannot be overestimated. Reports by the Santa Clara County Flood Control and Water District indicate that there has been a long-term lowering of ground water tables below safe and economic operating levels.

Santa Clara County has three major interconnected ground water basins. They are the Santa Clara Valley, the Coyote, and the Llagas Ground Water Basins. There are other small ground water basins within the county, but their use at present is small. The Santa Clara Valley Ground Water Basin is not in the Eastern Santa Clara Area.

The Coyote Ground Water Basin is the smallest of the three major basins. It occupies about 9,000 acres between the northerly Santa Clara Valley Ground Water Basin and a southerly divide in the vicinity of Cochran Road, just north of Morgan Hill. It is estimated that 14,000 acre-feet of ground water was extracted for use in 1965–66; no overdraft is estimated for this period.

The Llagas Ground Water Basin, which occupies about 57,000 acres, is the most southerly one and extends from Cochran Road on the north to the Pajaro River on the south. In 1966 about 70,000 acre-feet of ground water was extracted from this basin for municipal and farming purposes; no overdraft is estimated for this period.

Rainfall on the valley floor and runoff from the tributary watersheds are the major sources of water available to replenish these ground water basins. Surface reservoirs on the major tributary streams store flood runoff that would otherwise be lost for later release to percolation areas, thereby increasing the amount of local water placed in underground storage. The Santa Clara County Flood Control and Water District delivers water on the surface. It has also contracted for supplemental water from the State Water Project and is constructing facilities for the distribution of this water to meet present and future demands. Projections of future farm, munipical, and industrial water needs show that additional water will be needed. Therefore, import water from the San Felipe Division of Central Valley Project will be contracted to the county for distribution by the Santa Clara County Flood Control and Water District.

Industry and Farming

The location of Santa Clara County in the region surrounding San Francisco Bay, its proximity to large western markets, and its educational institutions have attracted a large number of nationally and internationally known firms. Most industrial growth has been in the northern part of Santa Clara Valley.

Since 1940 farm output has increased, even though there has been a shift in its relative importance. The largest income was derived from fruits, nuts, and berries (*4*). Nursery products increased in importance to become the second most valuable income crop. Livestock, poultry, and vegetable crops are other high-income enterprises.

Population

The population of Santa Clara County increased from 642,300 in 1960 to 919,700 in 1966. By 1970 the population was estimated to be approximately 1,125,000. In the southern part of the county, however, there has been only a slight increase in population. The County Planning Department has estimated that the population, which was 22,000 in 1960, could increase to 117,000 by 1980.

Community Facilities

Two universities and a State college are near the survey area: Stanford University, near Palo Alto; Santa Clara University, in Santa Clara; and San Jose State College, in San Jose. In addition, three theological schools are in the area. The Lick Observatory of the University of California is located 26 miles from San Jose in the northeastern part of the survey area, on the summit of Mount Hamilton.

Public schools in the county include kindergartens, elementary schools, junior high schools, senior high schools, and four junior colleges. In rural areas, an extensive school bus system provides easy access to schools for children living in nearly every part of the area. Churches of many denominations are in the area.

The county maintains several parks in the area for outdoor recreation, and golf courses are located throughout the area. Several of the water-storage reservoirs are used for fishing, swimming, and boating. The Santa Cruz Mountains, particularly the timbered parts, have long been summer recreational areas. Many summer homes are located in the Llagas and Uvas Creek drainage area and elsewhere in the mountains.

Transportation

The survey area is served by two trancontinental railroads, the Southern Pacific and the Western Pacific.

U.S. Highway 101, which connects San Diego, Los Angeles, San Francisco, Portland, and Seattle, passes through the area. State Highway 17 connects San Jose with Oakland and Santa Cruz. Numerous paved county roads crisscross the area and allow easy and direct transportation by truck or automobile between points within and outside the area.

A commercial airport is located at San Jose. Also, an international airport is located at San Francisco. Both transoceanic flights and flights east are scheduled daily from San Francisco.

Most of the processed foods and commercial cut flowers are trucked to the nearby San Francisco Bay area for shipment around the world. Much of the fresh farm produce of the area is marketed within a radius 50 miles from San Jose.

Vegetation

Approximately 15 percent of the area is grassland, which is in the foothills on both sides of the Santa Clara Valley and on the south slopes of the Diablo Range. Grassland consists predominantly of annual grasses, such as slender oats or wild oats, soft chess, ripgut brome, and foxtail fescue. In a few places, perennial purple needlegrass grows in considerable abundance. Commonly associated with the grasses are herbs such as filaree and burclover. Thistle and morningglory are the chief weeds of economic importance in the area. There are some areas of Klamath weed and puncturevine, and the county is sponsoring work to prevent their spread. Grasses predominate in winter and spring, but herbs generally are more conspicuous late in summer and in autumn. These areas are mostly used for grazing.

Grass and oak trees make up about 15 percent of the area and cover easterly slopes of the foothills and the Diablo Range. In the Diablo Range, open stands of trees are principally coast live oak, California black oak, California blue oak, and valley white oak. The herbaceous vegetation is similar to that in areas of grassland. These areas are used principally for grazing.

About 20 percent of the survey area is brushland. The largest area of brushland is east of Mt. Hamilton. Other large areas also occur in the Santa Cruz Mountain area. Brushland is closely related to lack of soil moisture and has replaced areas of forest or grassland. It consists of shrubs that are mainly hard and woody. Among the associated plants are manzanita, scrub oak, canyon live oak, Jimbrush, birchleaf mountain-mahogany, Christmasberry, poison-oak, chamise, and chaparral-pea. Areas of brushland provide an effective watershed cover, but they also create a fire hazard.

About 20 percent of the survey area is woodland. Woodland covers the northern and protected slopes of the Santa Cruz Mountains and the Diablo Range. It consists of various broad-leaved or hardwood trees that form fairly dense, closed-canopy stands. Predominant species are coast live oak, canyon live oak, California black oak, madrone, tanoak, and California laurel.

Forest land makes up less than 5 percent of the survey area. It occurs in small areas of the Santa Cruz Mountains. Stands of trees contain both redwood and Douglas-fir, and each of these species makes up about 20 percent or more of the total stand. Tanoak, madrone, and coast live oak are also in these stands. There is an undergrowth of shrubs such as poison-oak, California blackberry, and California huckleberry, and several species of fern are commonly present. The trees on forest land are young, mainly from 40 to 80 years old. They normally range in height from 60 to 130 feet, and in diameter from 8 to 36 inches. In the past, a few small areas have been used for the production of timber but now are not considered important.

The remaining 25 percent of the survey area is cultivated farmland, which is on the valley floor and adjacent foothills and terraces. Vegetation before cultivation began consisted of large, scattered valley white oaks and coast live oaks that had an understory of grasses and weeds. A few stands of eucalyptus, once planted for windbreaks and fast-growing timber, are at scattered locations on the valley floor and foothills.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available water holding capacity. The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and commonly have mottlings below 6 to 16 inches, in the lower A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Effective rooting depth. Depth to which a soil is readily penetrated by roots and utilized for extraction of water and plant nutrients. Limits of depth classes are:

Depth class	*Inches*
Very deep	More than 60
Deep	40 to 60
Moderately deep	20 to 40
Shallow	10 to 20
Very shallow	Less than 10

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Gleyed soil. A soil in which waterlogging and lack of oxygen have caused the material in one or more horizons to be neutral gray in color. The term "gleyed" is applied to soil horizons with yellow and gray mottling caused by intermittent waterlogging.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rains. The distinction between gully and rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by normal tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage. V-shaped gullies result if the material is more difficult to erode with depth; whereas U-shaped gullies result if the lower material is more easily eroded than that above it.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Montmorillonite. A fine, platy, alumino-silicate clay mineral that expands and contracts with the absorption and loss of water. It has a high cation-exchange capacity and is plastic and sticky when moist.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Organic matter. A general term for plant and animal matter, in or on the soil, in all stages of decomposition. Readily decomposed organic matter is often distinguished from the more stable forms that are past the stage of rapid decomposition.

Pan. A layer in a soil that is firmly compacted or very rich in clay. Frequently the word "pan" is combined with other words that more explicity indicate the nature of the layers; for example, *hardpan*, *fragipan*, *claypan*, and *traffic pan.*

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow*, *slow*, *moderately slow*, *moderate*, *moderately rapid*, *rapid*, and *very rapid.*

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Relief. The elevations or inequalities of a land surface, considered collectively.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays, where there is marked change in moisture content.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very course sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Type, soil. A subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven-dry basis, at which plants (specifically sunflower) wilt so much that they do not recover when placed in a dark, humid atmosphere.

U. S. DEPARTMENT OF AGRICULTURE

Washington, D. C. 20013

Soil Survey of Eastern Santa Clara Area, California

ERRATUM

The following symbols are incorrect on some map sheets in the Eastern Santa Clara Area Soil Survey:

Incorrect Symbols	Correct to
Ce	Cd
Ch	Cg
Cg	Ch
Su	Sv
Sv	Su

The above symbols are incorrect on map sheets 9, 10, 15, 17, 21, 27, 28, 33, 39, 40, 44, 45, 46, and 49, except in the following locations:

Map sheet 9 - Two small areas of (Cg) surrounding small lake that is NW of large reservoir in central part of map.

Map sheet 45 - Small area of (Ce) located near base of map, dominantly between highway 101 and the Southern Pacific Railroad, and dissected by Tick Creek.

Large area of (Ce) located directly east of the town of Camadero and dissected by Llagas Creek.

Map sheet 49 - Small area of (Ce) located at top of map sheet directly east of the Southern Pacific Railroad and west of Tick Creek.

MAY 2 1978

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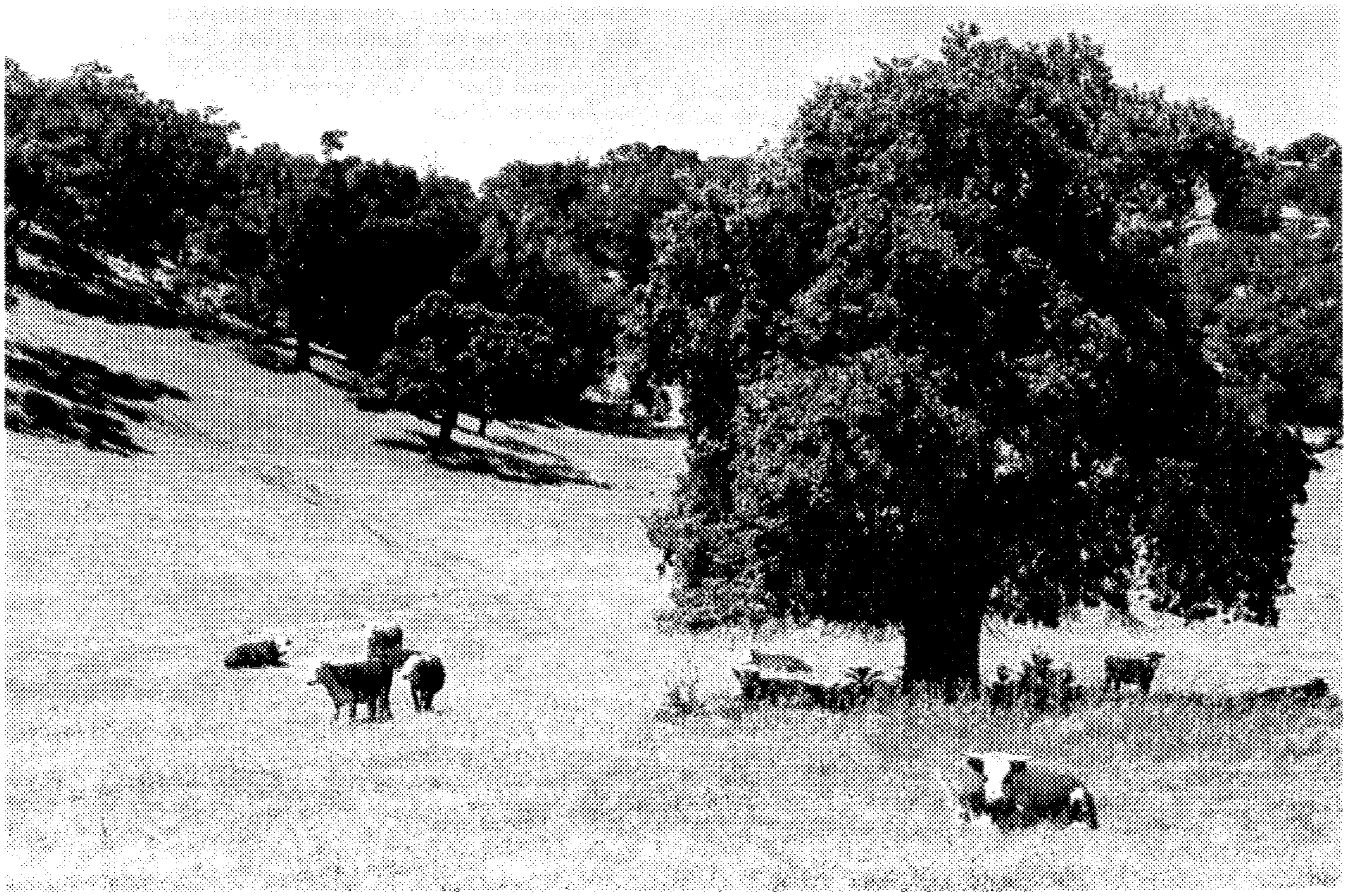
Issued November 1969

SOIL SURVEY
SAN BENITO COUNTY
California



UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
UNIVERSITY OF CALIFORNIA
AGRICULTURAL EXPERIMENT STATION

Major fieldwork for this soil survey was done in the period 1955–61. Soil names and descriptions were approved in 1965. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1962. This survey was made cooperatively by the Soil Conservation Service and the University of California Agricultural Experiment Station and is part of the technical assistance furnished to the Bitterwater, San Felipe, San Juan Bautista, Elkhorn, and Bolado-Fairview Soil Conservation Districts.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY of San Benito County contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, or other structures; and in judging tracts of land for agriculture, industry, or recreation.

Locating Soils

All of the soils of San Benito County are shown on the detailed map at the back of this survey. This map consists of many sheets that are made from aerial photographs. Each sheet is numbered to correspond with numbers shown on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbol. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information in the survey. This guide lists all of the soils of the county in alphabetic order by map symbol. It shows the page where each kind of soil is described, and also the page for the capability unit, pasture and range site, or any other group in which the soil has been placed.

Individual colored maps showing the relative suitability or limitations of soils for many specific purposes can be developed by using the soil map and information in the text. Interpretations not included in the text can be developed by grouping the soils according to their limitations for a particular use. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils in the soil descriptions and in the discussions of the capability units and pasture and range sites.

Ranchers and others interested in pasture and range can find under "Management of Pasture and Range" groupings of the soils according to their suitability for pasture and range, and also the plants that grow on each site.

Engineers and builders will find under "Engineering Uses of the Soils" tables that give engineering properties of the soils in the county and that name soil features that affect engineering practices and structures.

Scientists and others can read about how the soils were formed and how they are classified in the section "Formation and Classification of Soils."

Newcomers in San Benito County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the County," which gives additional information about the county.

***Cover picture.*—Dryland pasture on Conejo clay loam, 2 to 9 percent slopes.**

U.S. GOVERNMENT PRINTING OFFICE: 1969

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Issued November 1969

SOIL SURVEY OF SAN BENITO COUNTY, CALIFORNIA

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UNITED STATES DEPARTMENT OF AGRICULTURE AND UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION

SAN BENITO COUNTY, near the coast of California (fig. 1), has a total land area of 1,396 square miles, or 893,440 acres. The county includes the southern end of the Santa Clara Valley, the eastern slopes of the Gabilan Range, and the western slopes of the Diablo Range. The county lies about 85 miles southeast of San Francisco and 25 miles inland from Monterey Bay. Hollister, in the north-central part of the county, is the largest town and the county seat.

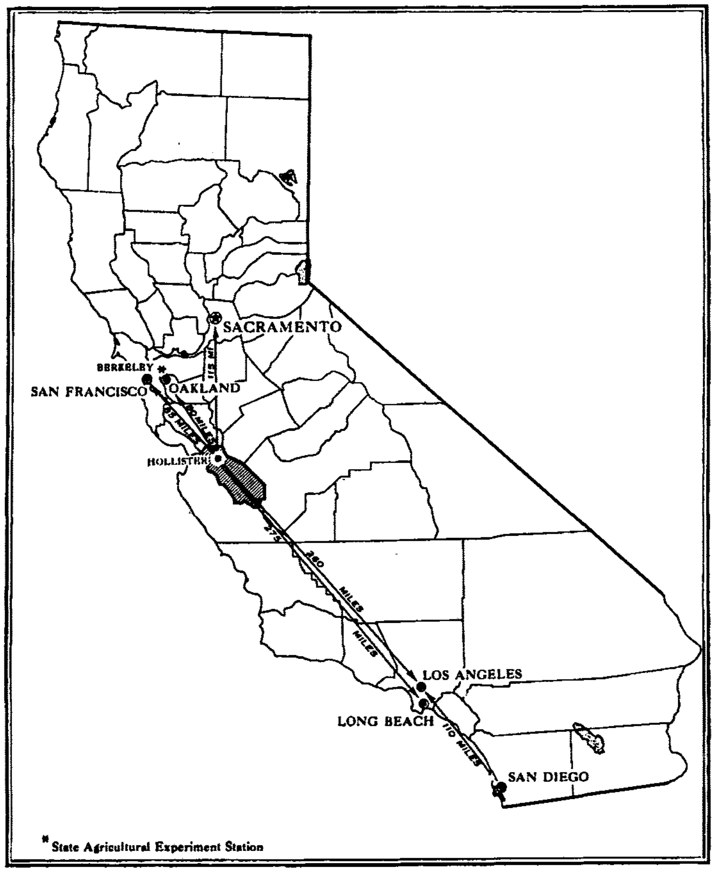

Figure 1.—**Location of San Benito County in California.**

The county is in the California Coast Range section of the Pacific Border physiographic province. It has a Mediterranean climate, and an average annual rainfall that ranges from 20 inches or more in the northern part to 12 inches or less along the southwestern border. Relief is characterized by mountains and valleys. Elevations range from 120 to more than 5,000 feet above sea level. The highest point in the county, 5,248 feet, is on San Benito Mountain.

Farming is the main source of income in San Benito County. The principal crops are fruits and nuts, vegetables and other row crops, and small grains. The raising of livestock, mainly beef cattle and sheep, is also important. Lack of water is the main factor limiting production in this county. Where water is available, irrigated fields are intensively cropped. Ponds and reservoirs are used for watering livestock on range and pasture.

Most of the cropland in the county consists of well-drained to poorly drained loamy and clayey soils that are on flood plains, on fans, on terraces, and in basins. Much of the pasture and rangeland also consists of loamy and clayey soils, but these soils are on uplands and are strongly sloping to steep.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in San Benito County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

The eleven soil associations in San Benito County are described on the following pages. More detailed information about the individual soils in each association can be obtained from the detailed soil map and the section "Descriptions of the Soils."

Soils of the Terraces, Alluvial Fans, and Flood Plains

The soils of the terraces are nearly level to steep, and the soils of the alluvial fans and flood plains are nearly level to moderately sloping. These soils formed in alluvium that was derived from sedimentary rocks and basic and acid igneous rocks. The soils in most areas are used for cultivated crops. Annual grasses, forbs, and some scattered oaks grow in uncultivated areas. Elevation ranges from 130 to 2,000 feet. The annual rainfall ranges from 6 to 20 inches and increases with elevation. The soils of this group occupy about 15 percent of the county and include most of the farmland. They lie in the San Benito, Santa Clara, Dry Lake, Topo, Quien Sabe, Bitterwater, and Panoche Valleys. Five soil associations make up this group.

1. Sorrento-Yolo-Mocho association

Nearly level to sloping, well-drained, medium-textured soils on flood plains and alluvial fans

This association consists of nearly level to sloping soils that formed in very deep alluvium derived from sedimentary rocks. The main areas are in San Benito, Santa Clara, Topo, Dry Lake, and Bitterwater Valleys. The plant cover consists of annual grasses, forbs, and some scattered oaks. The annual rainfall is 12 to 20 inches, the mean annual temperature is 59° to 64° F., and elevation ranges from 140 to 1,400 feet. The frost-free season is about 260 to 275 days. This association occupies about 6 percent of the county.

The Sorrento soils make up about 45 percent of the association; Yolo soils, about 20 percent; and Mocho soils, about 15 percent. The remaining 20 percent consists of Docas and Metz soils, Riverwash, Sandy alluvial land, and Terrace escarpments.

The dominant Sorrento, Yolo, and Mocho soils are very deep and well drained. The Sorrento soils have a grayish-brown silt loam surface layer underlain by light brownish-gray, calcareous silt loam. The Yolo soils have a brown to grayish-brown loam surface layer over pale-brown loam. The Mocho soils have a surface layer of grayish-brown loam that is underlain by light brownish-gray loam to fine sandy loam.

In this association are some of the most productive soils in the county. The soils are used for irrigated fruits and nuts, row and field crops, alfalfa, and pasture. They are used for small grain and pasture when dryfarmed. Except on streambanks, the soils are subject to little or no erosion. A few pheasant and quail live on this association.

2. Clear Lake-Pacheco-Willows association

Nearly level and gently sloping, poorly drained and somewhat poorly drained, fine- and medium-textured soils on flood plains and in basins

This association consists of nearly level and gently sloping soils that formed in alluvium derived from sedimentary rocks. The main area extends southeastward from the Santa Clara County line to a point just north of Hollister. The plant cover consists of annual grasses, forbs, and salt-tolerant plants. The annual rainfall is about 20 inches, the mean annual temperature is 60° F., and elevation ranges from 130 to 400 feet. The frost-free season is about 250 to 260 days. This association occupies about 3 percent of the county.

The Clear Lake soils make up about 40 percent of the association; Pacheco soils, about 25 percent; and Willows soils, about 20 percent. The remaining 15 percent consists of Metz, Rincon, and Cropley soils and Riverwash.

The Clear Lake soils consist of poorly drained, very dark gray clays underlain by dark-gray clay over gray clay. These soils are in basins. The Pacheco soils are on flood plains and are somewhat poorly drained to poorly drained. They have a dark-gray silt loam surface layer and a grayish-brown clay loam subsoil. The Willows soils occur in basins and are poorly drained and saline-alkali. They have a grayish-brown clay surface layer underlain by light yellowish-brown clay.

The soils of this association are intensively cultivated to row and field crops, alfalfa, and small grains. Fruits and nuts are grown in areas that have been drained. Drainage is needed in most areas, and reclamation is needed in areas affected by salts and alkali. A limited number of pheasants, quail, and ducks inhabit this association.

3. Edenvale-Conejo association

Nearly level to sloping, somewhat poorly drained to well-drained, fine- and moderately fine-textured soils in basins and on their rims

This association consists of very deep, nearly level to sloping soils that formed in alluvium. The alluvium was derived from rhyolite, andesite, basalt, and serpentine of the surrounding hills. This association occurs only in a small area in Quien Sabe Valley. The plant cover is annual grasses and forbs and scattered oaks. The annual rainfall is 14 to 18 inches, the mean annual temperature is about 60° F., and elevations range from 1,200 to 2,000 feet. The frost-free season is 250 to 260 days. This association occupies about 1 percent of the county.

The Edenvale soils make up about 55 percent of the association, and the Conejo soils make up 40 percent. The remaining 5 percent consists of Cibo soils, which are on hills surrounding the Edenvale and Conejo soils.

The Edenvale soils are somewhat poorly drained and are affected by salts and alkali in some areas. These soils are very dark gray clay throughout the profile. Conejo soils are well drained and have a very dark gray clay loam surface layer underlain by dark grayish-brown clay loam.

The small supply of irrigation water limits use of the soils in this association to mainly dryland grain and pasture. Drainage is also a problem in some areas. Because the proportion of magnesium to calcium is high in the Edenvale soils, they may be less fertile than the Conejo soils. A few pheasants and ducks inhabit this association.

4. Panoche-Los Banos-Panhill association

Nearly level to steep, well-drained, medium- and moderately fine-textured soils on alluvial fans and terraces

This association consists of nearly level to sloping soils on alluvial fans and nearly level to steep soils on high terraces. The alluvium of the fans was derived from sedimentary rock of the surrounding hilly to steep uplands. The alluvium of the terraces was derived from mixed sources and is older and more gravelly than that of the fans. The terraces are strongly dissected and have nearly level tops and undulating to steep side slopes. The vegetative cover of this association consists of annual grasses and forbs. The annual rainfall ranges from 6 to 12 inches, and elevation ranges from 1,200 to 2,000 feet. The mean annual temperature is 62° to 63° F., and the frost-free season is about 260 to 265 days. This association occupies about 3 percent of the county and occurs in Panoche Valley.

The Panoche soils make up 55 percent of this association; Los Banos soils, 25 percent; Panhill soils, 15 percent; and minor soils, the rest. The main minor soils are the Docas and Kettleman.

The Panoche soils are very deep and well drained and consist of pale-brown, calcareous loam. The Los Banos soils have a brown clay loam surface layer and a reddish-brown clay subsoil. They are moderately deep over a semiconsolidated substratum that limits the penetration of roots and water. Panhill soils have a profile consisting of very deep, light yellowish-brown loam. These soils are neutral in the surface layer but become calcareous with depth. The content of clay is slightly less in the surface layer than in the subsoil.

The soils of this association are used for annual-grass pasture and for irrigated cotton, alfalfa, safflower, wheat, and barley. Water for irrigation, however, is available only in parts of this association. Because areas in pasture have been overgrazed, the sloping soils are eroded. Los Banos soils are rilled and gullied and have other bare areas. Gullying and erosion of streambanks are a serious hazard along the drainageways and streams in this association. Some deer, quail, and pheasants live in areas where water is available.

5. *Rincon-Antioch-Cropley association*

Nearly level to strongly sloping, well-drained and moderately well drained, medium- to fine-textured soils on terraces and alluvial fans

This association consists of nearly level to strongly sloping soils on fans and terraces. It occupies a broad area of soils that are nearly level as they grade toward the valley floor but that are strongly sloping as they break sharply near the drainageways. The area extends from the Santa Clara County line southward along Santa Ana and Tres Pinos Creeks to Cottonwood School. The plant cover in uncultivated areas consists of annual grasses, forbs, and scattered oaks. The climate is semiarid; the annual rainfall is 12 to 16 inches. The mean annual temperature is 59° to 62° F., and the frost-free season is about 260 days. Elevation ranges from 130 to 1,500 feet. This association occupies about 2 percent of the county.

Rincon soils make up about 55 percent of this association; Antioch soils, about 25 percent; and Cropley soils, about 15 percent. The remaining 5 percent consists of Clear Lake, Pleasanton, and Sorrento soils.

The Rincon soils are very deep and well drained. They have a dark grayish-brown silty clay loam surface layer and a brown clay subsoil underlain by a light yellowish-brown clay loam substratum. The Antioch soils are moderately well drained and have a grayish-brown to gray, acid loam surface layer that extends to a depth of less than 20 inches and is underlain by a brown, slightly acid to alkaline, dense clay subsoil. The subsoil grades to a light yellowish-brown loam substratum. Permeability is very slow, and penetration of roots is limited. The Cropley soils are very deep and well drained. They have a clay texture to a depth of about 42 inches. They have a very dark gray surface layer that grades to a grayish-brown substratum. Cropley soils crack deeply as they dry out.

The soils of this association are used for fruits, nuts, alfalfa, row and field crops, and annual-grass pasture. Grain is grown both with and without irrigation. Erosion is a problem on the more sloping soils. In some places the irrigation water is of poor quality because the content of boron is high.

Soils of the Uplands

The soils of the uplands are strongly sloping to very steep. They are underlain by granitic, basic igneous, ultrabasic, and sedimentary rocks. Granitic rocks occur mainly along the Monterey County line in the southwestern part of the county; basic rocks are present throughout the eastern half; ultrabasic rocks occur in the southern part; and sedimentary rocks are in the central and eastern parts. The soils of the uplands occupy parts of the Gabilan and Diablo Ranges. These ranges have a northwestern trend parallel to the underlying bedrock. Annual rainfall ranges from about 8 to 30 inches, and elevation ranges from 200 to more than 5,000 feet. The soils of the uplands occupy about 85 percent of the county. They make up six soil associations.

6. *Diablo-Soper association*

Strongly sloping to very steep, well-drained, fine- and moderately coarse-textured soils formed over sandstone and shale or weakly cemented sand and gravel

This association consists of strongly sloping to very steep soils on uplands. These soils are underlain by weakly consolidated sediments of soft interbedded sandstone, conglomerate, and clay shale at a depth of 36 to 60 inches or more. This association occurs west and northeast of San Juan Bautista. Annual grasses and forbs along with scattered oaks and brush grow in most areas. Rainfall is 12 to 20 inches, and elevation ranges from 200 to 2,000 feet. The mean annual temperature is about 68° F., and the frost-free season is 250 to 260 days. This association occupies 3 percent of the county.

Diablo soils make up about 75 percent of this association, and Soper soils make up 20 percent. The Arnold and Cotati soils are minor soils and make up the remaining 5 percent. The Arnold soils are undulating to hilly and occur on old sand dunes, and the Cotati soils are on terraces along the foothills.

The Diablo and Soper soils are rolling to very steep and occur mainly on the smoothly rounded hills. Diablo soils are very deep over clay shale. They are well drained and have a very dark gray clay surface layer over a dark grayish-brown to pale-olive clay substratum. The Soper soils are deep and well drained. They have a dark grayish-brown sandy loam surface layer, a brown sandy clay loam subsoil, and a stratified substratum over semiconsolidated sand and fine gravel.

The soils of this association are used for grain, annual-grass pasture and for range, watersheds, and some community developments. Dense stands of eucalyptus trees have been planted on some of the soils. The hazard of erosion is severe, particularly on the Arnold, Soper, and Cotati soils. Many landslides occur on the Diablo soils, which are underlain by soft sediments. A few deer live in this association.

7. San Benito-Gazos-Linne association

Rolling to very steep, well-drained and somewhat excessively drained, moderately fine-textured soils formed over sandstone and shale

This association consists of rolling to very steep soils on hilly to mountainous uplands. At a depth of more than 20 inches, these soils are underlain by soft sediments, sandstone, shale, conglomerate, and mudstone. This association is the largest one in the county. It takes in the foothills of the Diablo and Gabilan Ranges and the hills and low mountains in the central and southwestern parts of the county. The annual precipitation ranges from 10 to 20 inches, and elevation ranges from 400 to 3,800 feet. The mean annual temperature is 60° to 62° F., and the frost-free season is about 260 days. This association makes up 39 percent of the county.

San Benito soils make up about 65 percent of the association; Gazos soils, 20 percent; Linne soils, 10 percent; and minor soils the remaining 5 percent. The minor soils are in the Sorrento, Diablo, Pinnacles, and Gaviota series.

San Benito soils are strongly sloping to steep and lie on hills and low mountains that extend southward from the San Juan and Hollister Valleys to Bitterwater and Hernandez Valleys. These soils have a dark grayish-brown clay loam surface layer underlain by a layer of light yellowish-brown clay loam that, in turn, is underlain by calcareous sandy shale. The Gazos soils are rolling to very steep and occur in the mountains southeast of Hernandez and Bitterwater Valleys. These soils have a surface layer of grayish-brown clay loam that grades to brown shaly clay loam, which overlies sandstone. The Linne soils are rolling to steep and occupy hills along the west side of Topo Valley. They have a gray clay loam surface layer that is underlain by light brownish-gray clay loam, which overlies calcareous shale.

The soils of this association are moderately to severely eroded and are used for small grain, annual-grass pasture and range, wildlife, watersheds, and recreation. Overgrazing has depleted the vegetation, and erosion is common. Eroded materials have been deposited in the small valleys and in reservoirs. Landslides are common throughout this association.

8. Kettleman-Nacimiento-Linne association

Strongly sloping to very steep, well-drained, medium- to moderately fine-textured soils formed over sandstone and shale

This association is made up of strongly sloping to very steep soils on hilly to mountainous uplands in the southeastern corner of the county (fig. 2). These soils are underlain by calcareous sandstone and shale at a depth of 20 to 60 inches or more. Annual grasses, forbs, and scattered oak trees grow in most places, but some areas are covered with brush. The annual rainfall is 8 to 16 inches, and elevation ranges from 700 to 3,000 feet. This association occupies about 12 percent of the county. The mean annual temperature is 60 to 62° F., and the frost-free season is 260 to 270 days.

Kettleman soils make up 50 percent of this association; Nacimiento soils, 30 percent; and Linne soils, 15 percent. The remaining 5 percent consists of many steep areas of Sedimentary rock land, large areas of Badland along Silver Creek, and soils formed in alluvium in small valleys and along drainageways.

The Kettleman, Nacimiento, and Linne soils are well drained, moderately deep to deep, and calcareous throughout. The Kettleman soils have a pale-brown loam surface layer over light yellowish-brown loam. These soils are underlain by calcareous soft sandstone and shale. The Nacimiento soils have a brown clay loam surface layer. The next layers are pale-brown and light yellowish-brown clay loam and are underlain by calcareous sandstone and shale. The Linne soils have a gray clay loam surface layer underlain by light brownish-gray clay loam over calcareous soft sandstone and shale.

The soils of this association are used for dryland grain, pasture and range, and for watersheds. The growth of grasses is limited by the low rainfall. Stands are commonly thin and are interspersed with many bare spots. Overgrazing further depletes the cover and results in sheet, rill, and gully erosion. The hazard of erosion is severe in most areas, particularly on the steep slopes.

9. Sheridan-Cieneba-Auberry association

Strongly sloping to very steep, well-drained to excessively drained, moderately coarse-textured soils formed over granite

This association consists of strongly sloping to very steep soils on hilly to mountainous uplands along the western side of the county from Fremont Peak to Topo Valley. These soils are shallow to very deep over strongly weathered granitic bedrock. The plant cover consists of annual grasses, forbs, and scattered Digger pines, Coulter pines, and oaks. The soils that are shallow over bedrock are typically covered with open to thick stands of brush. The annual rainfall ranges from 14 to 30 inches, and elevation ranges from 1,000 to 3,800 feet. The mean annual temperature is 56 to 60° F., and the frost-free season is 240 to 250 days. The association occupies about 11 percent of the county.

The Sheridan soils make up about 70 percent of the association; Cieneba soils, 15 percent; and Auberry soils, 10 percent. The remaining 5 percent consists of Igneous rock land, small areas of limestone and marble, and of San Benito and Hanford soils.

The Sheridan soils have a surface layer of dark grayish-brown coarse sandy loam that is underlain by dark grayish-brown to brown coarse sandy loam. The Cieneba soils have a pale-brown gravelly sandy loam surface layer that overlies strongly weathered granite at a depth of 18 inches or less. The Auberry soils have a dark grayish-brown fine sandy loam surface layer over a strong-brown coarse sandy clay loam subsoil. Weathered granite is at a depth of 24 to more than 60 inches. This granite is strongly weathered and is slowly permeable to water. It limits the growth of roots.

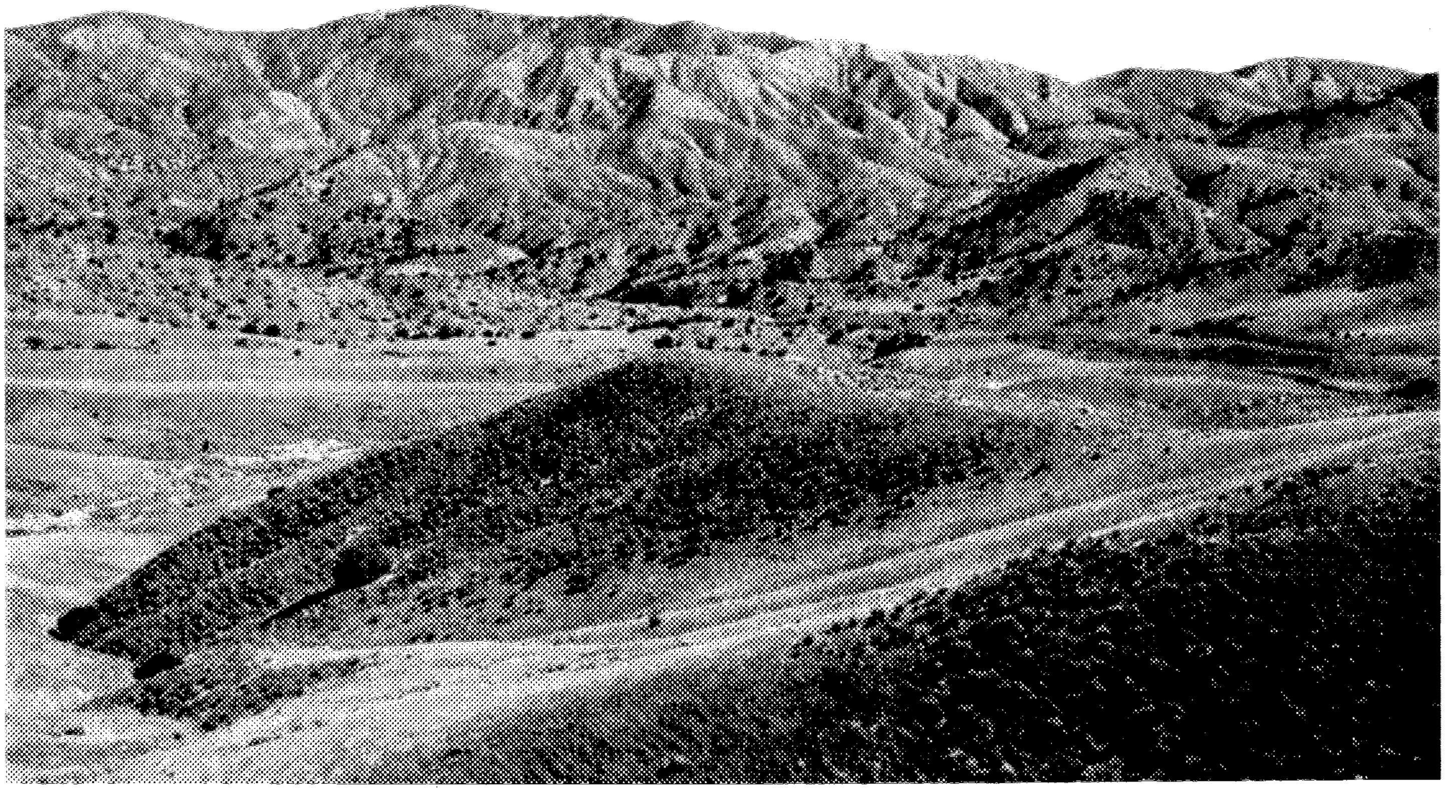

Figure 2.—**The Kettleman-Nacimiento-Linne association in the Cedar Flat area in the hills to the east of Vallecitos Valley.**

This association is used for pasture, range, watersheds, wildlife, and recreation. North of McPhails Peak, forage plants grow well and there are small areas of pine. Elsewhere in this association forage plants are not well adapted. The hazard of erosion is moderate to severe on the soils of this association. Overgrazing and wildfires have resulted in sheet and gully erosion, and large amounts of sediments are deposited on the lowlands. Wildlife consists mainly of deer, rabbits, and quail, and there are some dove and wild pigeon.

10. *Vallecitos-Gaviota-Cibo association*

Strongly sloping to very steep, well-drained and somewhat excessively drained, medium- and fine-textured soils formed over sandstone, shale, or basic igneous rocks

This association is made up of strongly sloping to very steep soils on hilly to mountainous uplands. It lies in the northeastern part of the county and extends from the Santa Clara County line south to Panoche Valley. Many rocky mountain peaks occur in the northern part of this association around Quien Sabe Valley. The soils of this association are underlain by basic igneous rocks, metamorphosed sandstone and shale, and sandstone at a depth of 8 to 40 inches. Growing in most areas are annual grasses and forbs and scattered stands of oaks and Digger pines. Oaks grow in thick stands on a few north-facing slopes, and scattered oaks and brush grow on eroded rocky slopes and in areas of rock land. Annual rainfall is 14 to 20 inches, and elevation ranges from 1,000 to 4,000 feet. The mean annual temperature is 60 to 62° F., and the frost-free season is 240 to 280 days. This association occupies about 17 percent of the county.

Vallecitos soils make up about 50 percent of the association; Gaviota soils, 30 percent; and Cibo soils, 15 percent. Climara and Montara soils are minor soils and make up the remaining 5 percent.

In this association the soils are well drained and somewhat excessively drained. The Vallecitos soils have a brown loam surface layer over a reddish-brown gravelly clay subsoil. They are underlain by metamorphosed sandstone and shale at a depth of 12 to 36 inches. The Gaviota soils have a pale-brown granular loam surface layer underlain by sandstone at a depth of 8 to 20 inches. The Cibo soils have a surface layer of dark-brown stony or rocky clay underlain by andesite, rhyolite, and basalt at a depth of 18 to 40 inches.

The soils of this association are used for range, watersheds, wildlife, and recreation. Where the range is properly grazed, forage plants grow well. Small rills and gullies have formed in overgrazed areas where the stand of grass is thin. The soils in most of the association are underlain by hard rock, and the damage from severe erosion is difficult to overcome. Species of wildlife include deer, rabbits, quail, and some dove and wild pigeon.

11. Igneous rock land-Henneke association

Igneous rock land and shallow, medium-textured soils formed over igneous rock

This association is made up of moderately steep to very steep soils on hilly to mountainous uplands. It occupies three areas in the southern part of the county. In these areas large intrusions of ultrabasic rock are at a depth of 9 to 20 inches. Also, basic and ultrabasic rock crop out in some areas. Most of this association is bare or is covered with brush and thin scattered stands of Digger and Coulter pines. Annual rainfall ranges from 14 to 20 inches, the mean annual temperature is about 60° F., and the frost-free season is about 250 days. Elevation ranges from 2,500 to more than 5,000 feet. San Benito Mountain, elevation 5,248 feet, is the highest point in the county. This association occupies 3 percent of the county.

Igneous rock land makes up about 55 percent of this association, and Henneke soils make up 40 percent. The remaining 5 percent consists chiefly of Montara soils.

Igneous rock land consists mostly of serpentine and some basalt. The Henneke soils are well drained to somewhat excessively drained. They have a brown fine gravelly loam surface layer and a reddish-brown very gravelly clay loam subsoil that overlies serpentine bedrock.

The soils of this association are used for watersheds and recreation. They have very low fertility, are subject to severe erosion, and require protection from grazing and wildfires. Large amounts of sediments eroded from these soils are deposited downstream.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in San Benito County, where they are located, and how they can be used.

They went into the county knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. To use this survey, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Cibo and San Benito, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that go with their behavior in the natural, untouched landscape. Soils of one series can differ somewhat in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Docas silt loam and Docas clay loam are two soil types in the Docas series. The difference in texture of their surface layers is apparent from their names.

Some types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Diablo clay, 9 to 15 percent slopes, is one of several phases of Diablo clay, a soil type that ranges from strongly sloping to very steep.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that greatly help in drawing boundaries accurately. The soil map in the back of this survey was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing some detailed maps the soil scientists have a problem of delineating areas where different kinds of soils are so intermingled and so small in size that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major kinds of soil in it, for example, Linne-Shedd complex, 15 to 30 percent slopes, eroded. Most surveys include areas where the soil material is so rocky, shallow, or so frequently worked by wind and water that it cannot be classified by soil series. These areas are shown on the map like other mapping units, but are given descriptive names, such as Igneous rock land, Landslides, or Terrace escarpments, and are called land types.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in a way that it is readily useful to different groups of readers, among them farmers, ranchers, managers of woodland, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil surveys. On the basis of the yield and practice tables and other data, the soil scientists set up trial groups, and then test them by further study and by consultation with farmers, agronomists, engineers, and others. Then the scientists adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

Descriptions of the Soils

In this section the soil series and the mapping units in each series are described. The description of a soil series mentions features that apply to all soils of that series. Differences among the soils of one series are pointed out in the descriptions of the individual soils or are indicated in the soil name. Unless otherwise stated, the profile described for the principal mapping unit, or the first after the series description, is considered representative for all the soils in the series.

Following the name of each mapping unit in the descriptions of the soils is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map, which is at the back of the survey. Listed at the end of each description is the capability unit and the pasture and range site assigned to the mapping unit.

For more generalized information about soils in different parts of the county, the reader can refer to the section "General Soil Map." The approximate acreage and proportionate extent of the soils are given in table 1, and a list of the soils mapped, along with the capability unit and pasture and range site of each, is given in the "Guide to Mapping Units" at the back of the survey. Definitions of many terms used in describing the soils are in the Glossary, and some of them are explained in detail in the "Soil Survey Manual" (*8*).[1]

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[1] Italic numbers in parentheses refer to Literature Cited, p. 109.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Antioch clay loam, 9 to 15 percent slopes, eroded	195	(1)
Antioch loam, 0 to 2 percent slopes	1, 815	0. 2
Antioch loam, 2 to 5 percent slopes	4, 095	. 5
Antioch loam, 5 to 9 percent slopes, eroded	430	(1)
Arguello loam, 2 to 9 percent slopes	220	(1)
Arguello shaly loam, 9 to 15 percent slopes	440	(1)
Arnold loamy sand, 9 to 15 percent slopes	260	(1)
Arnold loamy sand, 15 to 30 percent slopes, eroded	1, 650	. 2
Arnold loamy sand, 30 to 50 percent slopes, severely eroded	575	. 1
Auberry fine sandy loam, 15 to 30 percent slopes	1, 405	. 2
Auberry fine sandy loam, 30 to 75 percent slopes, eroded	5, 360	. 6
Badland	33, 820	3. 8
Botella loam, 0 to 2 percent slopes	480	. 1
Botella loam, 2 to 9 percent slopes	330	(1)
Cibo rocky clay, shallow, 15 to 75 percent slopes, eroded	18, 150	2. 0
Cibo stony clay, 15 to 50 percent slopes, eroded	6, 775	2. 8
Cieneba gravelly sandy loam, 15 to 75 percent slopes, severely eroded	3, 910	. 4
Cieneba gravelly sandy loam, 30 to 75 percent slopes, eroded	9, 005	1. 0
Clear Lake clay	5, 090	. 6
Clear Lake clay, saline	4, 885	. 5
Clear Lake silty clay loam	550	. 1
Climara clay, 9 to 15 percent slopes	545	. 1
Climara clay, 15 to 50 percent slopes, eroded	5, 605	. 6
Cometa loam, 5 to 15 percent slopes, eroded	435	(1)
Cometa sandy loam, 5 to 15 percent slopes, eroded	225	(1)
Conejo clay loam, 2 to 9 percent slopes	2, 445	. 3
Corralitos loamy sand, 2 to 9 percent slopes	375	(1)
Cotati loam, 2 to 9 percent slopes	1, 095	. 1
Cotati loam, 9 to 15 percent slopes, eroded	695	. 1
Cotati loam, 15 to 30 percent slopes, eroded	565	. 1
Cropley clay, 0 to 2 percent slopes	640	. 1
Cropley clay, 2 to 9 percent slopes	2, 210	. 2
Cropley silty clay loam, 2 to 9 percent slopes	725	. 1
Diablo clay, 9 to 15 percent slopes	3, 360	. 4
Diablo clay, 15 to 30 percent slopes, eroded	13, 915	1. 6
Diablo clay, 30 to 50 percent slopes, eroded	19, 805	2. 2
Diablo clay, 50 to 75 percent slopes, severely eroded	1, 975	. 2
Diablo-Linne complex, 9 to 15 percent slopes	1, 055	. 1
Diablo-Linne complex, 15 to 30 percent slopes, eroded	1, 740	. 2
Diablo-Linne complex, 30 to 50 percent slopes, eroded	700	. 1
Docas clay loam, 0 to 2 percent slopes	1, 405	. 2
Docas clay loam, 2 to 9 percent slopes	1, 430	. 2
Docas silt loam, 0 to 2 percent slopes	1, 165	. 1
Docas silt loam, 2 to 9 percent slopes	1, 920	. 2
Edenvale clay, 0 to 2 percent slopes	3, 525	. 4
Gaviota loam, 15 to 30 percent slopes	995	. 1
Gaviota loam, 15 to 30 percent slopes, eroded	820	. 1
Gaviota loam, 30 to 50 percent slopes, eroded	8, 665	1. 0
Gaviota rocky loam, 15 to 50 percent slopes, eroded	30, 410	3. 4
Gazos clay loam, 15 to 30 percent slopes, eroded	4, 035	. 5
Gazos clay loam, 30 to 50 percent slopes, eroded	14, 350	1. 6
Gazos clay loam, 50 to 75 percent slopes, severely eroded	4, 610	. 5
Gazos silty clay loam, 9 to 15 percent slopes	290	(1)
Gullied land	350	(1)
Hanford coarse sandy loam, 0 to 2 percent slopes	1, 340	. 1
Hanford coarse sandy loam, 2 to 9 percent slopes	3, 005	. 3
Hanford loam, 0 to 2 percent slopes	355	(1)
Hanford loam, 2 to 9 percent slopes	270	(1)
Henneke fine gravelly loam, 15 to 50 percent slopes, eroded	5, 620	. 6
Henneke soils, 15 to 75 percent slopes, severely eroded	14, 360	1. 6
Igneous rock land	30, 650	3. 4
Kettleman loam, 5 to 15 percent slopes	4, 155	. 5
Kettleman loam, 15 to 50 percent slopes, eroded	11, 000	1. 2
Kettleman soils, 15 to 50 percent slopes, eroded	28, 110	3. 1
Laniger gravelly sandy loam, 30 to 75 percent slopes, severely eroded	6, 845	. 8

See footnote at end of table.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Area	Extent
	Acres	*Percent*
Landslides	7, 730	. 9
Linne clay loam, 9 to 15 percent slopes	995	. 1
Linne clay loam, 15 to 30 percent slopes, eroded	5, 800	. 6
Linne clay loam, 30 to 50 percent slopes, eroded	9, 350	1. 0
Linne clay loam, 30 to 50 percent slopes, severely eroded	1, 405	. 1
Linne-Shedd complex, 15 to 30 percent slopes, eroded	355	(1)
Linne-Shedd complex, 30 to 50 percent slopes, eroded	5, 240	. 6
Lodo shaly loam, 50 to 75 percent slopes, eroded	1, 835	. 2
Los Banos clay loam, 2 to 9 percent slopes	2, 535	. 3
Los Banos clay loam, 9 to 15 percent slopes, eroded	660	. 1
Los Banos clay loam, 15 to 50 percent slopes, severely eroded	3, 480	. 4
Los Gatos clay loam, 15 to 30 percent slopes	2, 940	. 3
Los Gatos clay loam, 30 to 50 percent slopes, eroded	3, 420	. 4
Los Gatos rocky clay loam, 15 to 50 percent slopes, eroded	715	. 1
Metz gravelly sandy loam, 0 to 2 percent slopes	670	. 1
Metz gravelly sandy loam, 2 to 9 percent slopes	340	(1)
Metz sandy loam, 0 to 2 percent slopes	1, 605	. 2
Metz sandy loam, wet variant, 0 to 2 percent slopes	490	. 1
Mine pits and dumps	940	. 1
Mocho clay loam, 2 to 9 percent slopes	305	(1)
Mocho gravelly loam, 2 to 5 percent slopes	340	(1)
Mocho loam, 0 to 2 percent slopes	1, 440	. 2
Mocho loam, 2 to 9 percent slopes	1, 090	. 1
Mocho sandy loam, 0 to 2 percent slopes	220	(1)
Mocho sandy loam, 2 to 9 percent slopes	495	. 1
Montara rocky silty clay loam, 15 to 50 percent slopes, eroded	2, 490	. 3
Nacimiento clay loam, 9 to 15 percent slopes	205	(1)
Nacimiento clay loam, 15 to 30 percent slopes	2, 295	. 3
Nacimiento clay loam, 30 to 50 percent slopes, eroded	8, 680	1. 0
Nacimiento clay loam, 50 to 75 percent slopes, eroded	3, 155	. 3
Nacimiento loam, 30 to 75 percent slopes, severely eroded	12, 140	1. 3
Pacheco clay loam over clay	975	. 1
Pacheco loam	1, 050	. 1
Pacheco silt loam	1, 820	. 2
Pacheco silty clay	4, 715	. 5
Panhill loam, 2 to 9 percent slopes	3, 615	. 4
Panoche loam, 0 to 2 percent slopes	7, 030	. 8
Panoche loam, 2 to 9 percent slopes	1, 855	. 2
Panoche sandy loam, 0 to 2 percent slopes	2, 415	. 3
Panoche sandy loam, 2 to 9 percent slopes	2, 260	. 2
Pinnacles coarse sandy loam, 15 to 30 percent slopes, eroded	1, 940	. 2
Pinnacles coarse sandy loam, 30 to 75 percent slopes, severely eroded	7, 415	. 8
Pinto sandy loam, 15 to 30 percent slopes, eroded	400	(1)
Pleasanton gravelly loam, 5 to 9 percent slopes, eroded	2, 395	. 3
Pleasanton loam, 2 to 5 percent slopes	3, 885	. 4
Reiff sandy loam, 0 to 2 percent slopes	3, 495	. 4
Reiff sandy loam, 2 to 9 percent slopes	2, 095	. 2
Rincon loam, 0 to 2 percent slopes	505	. 1
Rincon loam, 2 to 9 percent slopes	2, 355	. 3
Rincon loam, 9 to 15 percent slopes, eroded	655	. 1
Rincon silty clay loam, 0 to 2 percent slopes	3, 435	. 4
Rincon silty clay loam, 2 to 9 percent slopes	4, 855	. 5
Rincon silty clay loam, 9 to 15 percent slopes, eroded	2, 475	. 3
Riverwash	5, 665	. 6
Salinas clay loam, 0 to 2 percent slopes	1, 660	. 2
Salinas clay loam, 2 to 9 percent slopes	505	. 1
San Benito clay loam, 9 to 15 percent slopes	4, 180	. 5
San Benito clay loam, 15 to 30 percent slopes, eroded	27, 240	3. 0
San Benito clay loam, 30 to 50 percent slopes, eroded	56, 475	6. 3
San Benito clay loam, 30 to 50 percent slopes, severely eroded	9, 640	1. 0
Sandy alluvial land	2, 910	. 3
Santa Lucia shaly loam, 30 to 50 percent slopes, eroded	3, 045	. 3
Santa Lucia shaly loam, 30 to 75 percent slopes, severely eroded	1, 570	. 2
Sedimentary rock land	88, 125	9. 9
Shedd loam, 9 to 15 percent slopes	1, 100	. 1
Shedd loam, 15 to 30 percent slopes, eroded	1, 445	. 2
Shedd loam, 30 to 50 percent slopes, eroded	4, 395	. 5
Shedd loam, 30 to 50 percent slopes, severely eroded	5, 365	. 6
Sheridan coarse sandy loam, 9 to 15 percent slopes	1, 365	. 1
Sheridan coarse sandy loam, 15 to 30 percent slopes	6, 330	. 7
Sheridan coarse sandy loam, 15 to 30 percent slopes, eroded	6, 735	. 8
Sheridan coarse sandy loam, 30 to 75 percent slopes, eroded	11, 860	1. 3
Sheridan coarse sandy loam, 30 to 75 percent slopes, severely eroded	38, 450	4. 3
Soper gravelly loam, 9 to 15 percent slopes	1, 375	. 1
Soper gravelly loam, 15 to 30 percent slopes, eroded	2, 805	. 3
Soper gravelly loam, 30 to 50 percent slopes, eroded	2, 260	. 2
Soper sandy loam, 9 to 15 percent slopes	215	(1)
Soper sandy loam, 15 to 30 percent slopes, eroded	2, 745	. 3
Soper sandy loam, 30 to 50 percent slopes, eroded	785	. 1
Sorrento gravelly loam, 0 to 5 percent slopes	680	. 1
Sorrento silt loam, 0 to 2 percent slopes	7, 865	. 9
Sorrento silt loam, 2 to 9 percent slopes	5, 655	. 6
Sorrento silty clay loam, 0 to 2 percent slopes	9, 650	1. 1
Sorrento silty clay loam, 2 to 9 percent slopes	2, 475	. 3
Sween rocky clay loam, 15 to 30 percent slopes, eroded	545	. 1
Sween rocky clay loam, 30 to 50 percent slopes, eroded	365	(1)
Sween stony clay loam, 15 to 30 percent slopes, eroded	2, 340	. 3
Sween very stony clay loam, 15 to 50 percent slopes, eroded	3, 910	. 4
Terrace escarpments	4, 235	. 5
Vallecitos loam, 9 to 15 percent slopes	630	. 1
Vallecitos loam, 15 to 30 percent slopes	6, 980	. 8
Vallecitos loam, 30 to 50 percent slopes	10, 545	1. 2
Vallecitos loam, 30 to 50 percent slopes, eroded	23, 015	2. 6
Vallecitos rocky loam, 9 to 30 percent slopes, eroded	575	. 1
Vallecitos rocky loam, 30 to 50 percent slopes, eroded	29, 535	3. 3
Willows clay	6, 370	. 7
Willows clay, saline-alkali	520	. 1
Willows sandy loam	185	(1)
Willows soils, eroded	1, 330	. 1
Yolo gravelly loam, 0 to 5 percent slopes	1, 085	. 1
Yolo loam, 0 to 2 percent slopes	1, 370	. 1
Yolo loam, 2 to 9 percent slopes	3, 105	. 3
Total	893, 440	100. 00

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[1] Less than 0.05 percent.

Antioch Series

The Antioch series consists of moderately well drained soils that formed in alluvium derived from a wide range of sedimentary rocks. These soils have a loamy surface layer and a clayey subsoil. They occur on terraces and are nearly level to strongly sloping. The vegetation consists of annual grasses, forbs, and some scattered oaks. Elevations are less than 1,000 feet above sea level. Annual rainfall ranges from 12 to 14 inches, average annual temperature is 62° F., and the frost-free period is about 260 days. The main associated soils are the Pleasanton, Rincon, and Sorrento.

The surface layer is loam or clay loam 12 to 20 inches thick. It ranges from grayish brown to gray. The subsoil is brown clay 15 to 34 inches thick. It ranges from medium acid to moderately alkaline in reaction. The substratum is light yellowish brown loam, very gravelly loam, or silty clay loam. It is stratified with sand and gravel in some places. The substratum ranges from neutral to moderately alkaline.

Antioch soils are used for dryland pasture and grain and for irrigated apricots, grapes, and prunes.

Antioch loam, 0 to 2 percent slopes (AnA).—This nearly level soil occurs on terraces.

Representative profile: On Basarich Ranch, McMahan Road, 10 yards to rear of barn, 400 yards east of house.

Ap—0 to 10 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, granular structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, very fine and fine, interstitial pores; medium acid; clear, smooth boundary.

A2—10 to 13 inches, gray (10YR 6/1) loam, dark gray (10YR 4/1) when moist; weak, medium, subangular blocky structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; many, very fine, tubular pores, common, very fine, interstitial pores; slightly acid; abrupt, smooth boundary.

B21t—13 to 25 inches, brown (10YR 5/3) clay, dark brown (10YR 3/3) when moist; strong, coarse, prismatic structure that breaks readily to moderate, fine, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; few very fine and fine roots; common, very fine and fine, tubular pores; thin continuous clay films on surfaces of peds and pores; many fine and medium slickensides; material from the A horizon in seams and on ped surfaces; slightly acid; gradual, smooth boundary.

B22t—25 to 37 inches, brown (10YR 5/3) clay, brown (10YR 4/3) when moist; strong, medium, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; few very fine and fine roots; few, very fine and fine, tubular pores; thin continuous clay films on surfaces of peds and pores; many fine and medium slickensides; mildly alkaline; gradual, smooth boundary.

B3—37 to 47 inches, light yellowish-brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) when moist; moderate, medium, angular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; few, very fine and fine, tubular pores; few, thin, patchy clay films on ped surfaces; moderately alkaline; slightly effervescent; clear, smooth boundary.

IIC1—47 to 54 inches, light yellowish-brown (10YR 6/4) very gravelly loam, dark yellowish brown (10YR 4/4) when moist; weak, fine, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; few, very fine and fine, tubular pores; moderately alkaline, slightly effervescent; clear, smooth boundary.

IIIC2—54 to 76 inches, light yellowish-brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) when moist; strong, fine, angular blocky structure; very hard when dry, very firm when moist, sticky and plastic when wet; brittle and compact in places; moderately alkaline; gradual, smooth boundary.

Included in mapping were small areas of Pleasanton and Rincon soils and a few small areas that have a sandy loam surface layer.

This soil has a very slowly permeable subsoil that limits penetration of roots and water. The root zone is moderately deep. Runoff is very slow, and small areas are ponded occasionally during the winter. The hazard of erosion is slight. The soil has moderate to low fertility. It holds about 3.75 to 5 inches of water available for plants.

This soil is used for dryland grain and pasture and irrigated fruits. Capability unit IIIs–3 (14); pasture and range site 4.

Antioch loam, 2 to 5 percent slopes (AnB).—This soil is on long terraces and fans. Runoff is slow, and the hazard of erosion is slight.

This soil is used for dryfarmed grain and pasture and irrigated fruits. Capability units IIIe–3 (14), IVe–3 (15); pasture and range site 4.

Antioch loam, 5 to 9 percent slopes, eroded (AnC2).—This soil is steeper than Antioch loam, 0 to 2 percent slopes and has a thinner surface layer. It occurs in small areas along drainageways or as breaks in areas of less sloping soil. Slopes are dominantly 5 to 7 percent. This soil is slightly to moderately eroded, and in some areas the plow layer extends into the subsoil. Runoff is medium, and the hazard of erosion is moderate.

This soil is used for dryland grain and pasture and for irrigated fruits. Capability units IIIe–3 (14), IVe–3 (15); pasture and range site 4.

Antioch clay loam, 9 to 15 percent slopes, eroded (AoD2).—This soil has a thinner surface layer than Antioch loam, 0 to 2 percent slopes. It occurs in small rolling areas or on sharp breaks along drainageways. Slopes are dominantly 9 to 12 percent. This soil is moderately eroded, and the plow layer commonly extends into the subsoil. Fertility is low, runoff is medium to rapid, and the hazard of erosion is moderate to severe.

Included in mapping were small areas that have a loam surface layer. This soil is used for dryland grain and pasture and in small areas for irrigated grapes. Capability unit IVe–3 (15); pasture and range site 4.

Arguello Series

The Arguello series consists of well-drained loamy soils that are underlain by stratified, shaly alluvium at a depth of more than 48 inches. The soils are gently sloping to strongly sloping. They occur on terraces and toe slopes. The vegetation is annual grasses and forbs, with scattered oaks and Digger pine. Elevations are 800 to 1,600 feet above sea level. Annual rainfall is 12 to 16 inches, average annual temperature is 60° F., and the frost-free period is about 260 days. The main associated soils are the Pinnacles, Santa Lucia, and Sheridan.

The surface layer is loam or shaly loam 18 to 24 inches thick. Its color ranges from gray through dark gray to grayish brown. The subsoil is gray clay loam that is 16 to 24 inches thick. The upper part of the substratum consists of light brownish-gray clay loam 10 to 20 inches thick. It is underlain by stratified very shaly alluvium that generally extends to a depth of more than 5 feet.

Arguello soils are used for dryland grain and pasture.

Arguello loam, 2 to 9 percent slopes (ArC).—This soil occurs along drainageways on the valley floor.

Representative profile: On Jef Schmidt Ranch, 1 mile south of junction of La Gloria Road and State Route 25; in a dryfarmed grain field on a slope of 4 percent, 500 yards downstream from pond.

Ap—0 to 6 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) when moist; weak, medium, subangular blocky structure that breaks readily to moderate, fine, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; few, fine, tubular pores and common, very fine, interstitial pores; few angular shale fragments; slightly acid (pH 6.5); clear, smooth boundary.

A1—6 to 21 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) when moist; weak, fine, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, fine and medium, tubular and interstitial pores; few angular shale fragments; two clay bands, ¼ to ¾ inch thick, in lower part; medium acid; smooth, gradual boundary.

B2t—21 to 36 inches, gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) when moist; weak, fine, subangular blocky structure; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; common, very fine and fine, tubular pores; few, angular, shale fragments; few, thin, patchy clay films on ped surfaces; strongly acid; clear, smooth boundary.

C1—36 to 50 inches, light brownish-gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; hard when dry, firm when moist, slightly sticky and plastic when wet; few very fine and fine roots; few, very fine and fine, tubular pores; few, small, angular shale fragments; strongly acid (pH 5.5); gradual, smooth boundary.

IIC2—50 to 60 inches, grayish-brown (10YR 5/2) very shaly clay loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure; hard when dry, firm when moist, slightly sticky and plastic when wet; few very fine and fine roots; few, very fine and fine, tubular pores; strongly acid.

Included with this soil are small areas of Rincon and Yolo soils and of Riverwash. Also included are some small areas that have a loam subsoil that is moderately permeable.

This soil has low fertility. Available water holding capacity is about 10 inches. Permeability is moderately slow, runoff is slow to medium, and the hazard of erosion is slight to moderate. The root zone extends to a depth of more than 60 inches.

This soil is used for dryland grain and incidental pasture. Capability unit IIIe-1 (15).

Arguello shaly loam, 9 to 15 percent slopes (AsD).—This shaly soil is more strongly sloping than Arguello loam, 2 to 9 percent slopes. It occurs in rolling areas or on toe slopes. Slopes are dominantly 9 to 12 percent. Some included areas are moderately eroded and others have slopes of more than 15 percent. Runoff is medium, and the hazard of erosion is moderate. Available water holding capacity is about 6 to 8 inches.

This soil is used for dryland grain and pasture. Capability unit IVe-1 (15); pasture and range site 2.

Arnold Series

The Arnold series consists of somewhat excessively drained sandy soils that are underlain by soft or very soft, medium-grained, acid sandstone. These soils are strongly sloping to steep. They occur on hilly uplands. Elevations range from 200 to 800 feet above sea level. Annual rainfall is 16 to 20 inches, average annual temperature is about 60° F., and the frost-free period is about 260 days. The vegetation is grass, grass and oak, grass and fern, or planted eucalyptus. The main associated soils are the Corralitos, Pinto, Soper, and Diablo.

The surface layer is pale-brown loamy sand 8 to 12 inches thick. The next layer is light-brown to light yellowish-brown loamy sand 22 to 48 inches thick. Below this is very soft sandstone. Depth to sandstone ranges from 30 to more than 60 inches. The profile is generally loamy sand throughout, but loamy fine sand occurs in some places. Reaction ranges from medium acid to strongly acid.

The Arnold soils are used for dryland and irrigated apricots, dryland grain, and pasture.

Arnold loamy sand, 30 to 50 percent slopes, severely eroded (AtF3).—This soil occurs on hills or uplands.

Representative profile: Nagelmaker Ranch, 100 yards north and 30 yards west of the end of Rea Road, on hillside.

Ap—0 to 12 inches, pale-brown (10YR 6/3) loamy sand, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure that breaks readily into moderate, fine, granular structure; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; abundant very fine and fine roots, few coarse roots; common, very fine and fine, interstitial pores; few, small, iron-cemented concretions about ⅛ to 1 inch in diameter; strongly acid; clear, smooth boundary.

C1—12 to 22 inches, light-brown (7.5YR 6/4) loamy sand, brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful very fine and fine roots, few coarse roots; many, very fine and fine, interstitial pores; few, small, iron-cemented concretions about ½ inch to 2 inches in diameter; strongly acid; gradual, smooth boundary.

C2—22 to 46 inches, light yellowish-brown (10YR 6/4) loamy sand, dark yellowish brown (10YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful very fine and fine roots, few coarse roots; many, very fine and fine, interstitial pores; common small fragments of soft sandstone; strongly acid; gradual, smooth boundary.

C3—46 inches, soft, yellowish-brown, acid sandstone.

Included with this soil are small areas of Corralitos, Pinto, and Soper soils. Also included are small areas of soils that have a sandy loam surface layer and soils that are alkaline throughout.

This soil has low fertility. Available water holding capacity is about 2 to 3 inches. Permeability is rapid, runoff is medium to rapid, and the hazard of erosion is severe to very severe. The root zone is moderately deep to deep.

This soil is used mainly for range. Some areas are used for dryland apricots, but many areas have been abandoned and are reverting to range. Capability unit VIIe-4 (15); pasture and range site 3.

Arnold loamy sand, 9 to 15 percent slopes (AtD).—This soil is similar to Arnold loamy sand, 30 to 50 percent slopes, severely eroded, but it is not so steep, is very deep over sandstone, and is only slightly eroded in most places. It occurs mostly on toe slopes along drainageways in areas of moderately steep soils.

The soil has available water holding capacity of about 4 to 5 inches. Runoff is slow, and the hazard of erosion is slight. The root zone is very deep.

This soil is used for dryland pasture. Areas that were cultivated have reverted to pasture. Capability unit IIIs-4 (14); pasture and range site 3.

Arnold loamy sand, 15 to 30 percent slopes, eroded (AtE2).—This soil is similar to Arnold loamy sand, 30 to 50 percent slopes, severely eroded, but is less steep, is only moderately eroded, and is deep over sandstone. It lies on moderately steep hills or on benchlike lower slopes in areas of steep hills. Slopes are dominantly between 20 and 25 percent. A few areas are severely eroded, and a few are gullied. Eroded material has accumulated in some places and on lower slopes. Runoff is medium, and total available water holding capacity is about 3 to 4 inches.

Most of this soil is used for pasture, but some areas are used for dryland apricots. Capability unit VIe-4 (15); pasture and range site 3.

Auberry Series

The Auberry series consists of well-drained loamy soils that are underlain by weathered granite at a depth of 2 to more than 5 feet. These soils are on hilly and mountainous uplands and are moderately steep to very steep. Elevations range from 1,000 to 3,000 feet above sea level. Annual rainfall is 20 to 30 inches, average annual temperature is 60° F., and the frost-free period is about 240 days. The vegetation is annual grasses, forbs, and thin to moderately thick stands of oaks and Digger pine. Some brush grows on steep, eroded slopes and in less sloping areas that were once cultivated. The main associated soils are the Sheridan, Cieneba, and San Benito.

The surface layer is dark grayish brown in color and fine sandy loam to coarse sandy clay loam in texture. It is 10 to 20 inches thick. The subsoil is strong-brown coarse sandy clay loam 14 to 24 inches thick. In some places the subsoil is underlain by strongly weathered granite. In other places it is underlain by yellowish-brown coarse sandy loam that, in turn, is underlain by strongly weathered granite. The substratum is 20 inches or more thick. Auberry soils vary in content of clay and in reaction of their subsoil.

Auberry soils are used for pasture, range, and watersheds and for wildlife and recreational areas.

Auberry fine sandy loam, 15 to 30 percent slopes (AuE).—This soil occurs as rounded ridgetops or as small moderately steep areas in the uplands.

Representative profile: On 101 Ranch, on main ranch road, three-quarters mile southwest of ranch headquarters.

A1—0 to 7 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure that breaks readily to moderate, fine, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, very fine, tubular pores and common, fine and medium, interstitial pores; medium acid; clear, smooth boundary.

A3—7 to 17 inches, dark grayish-brown (10YR 4/2) coarse sandy clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; few, fine and medium, tubular pores and many, very fine, fine, and medium, interstitial pores; medium acid; gradual, smooth boundary.

B2t—17 to 37 inches, strong-brown (7.5YR 5/6) coarse sandy clay loam, strong brown (7.5YR 4/6) when moist; moderate, medium, angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; plentiful very fine and fine roots; common, very fine and fine, tubular pores and few, very fine and medium, interstitial pores; thin continuous clay films on ped and pore surfaces; medium acid; gradual, irregular boundary.

C1—37 to 64 inches, yellowish-brown (10YR 5/6) coarse sandy loam, dark yellowish brown (10YR 4/6) when moist; weak, coarse, subangular blocky structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; few, very fine and fine, tubular pores and few, fine and medium, interstitial pores; medium acid; gradual, wavy boundary.

C2—64 to 100 inches, yellowish-brown and gray, strongly weathered granite.

Strongly weathered granite is at a depth ranging from 2 to more than 5 feet, and it limits the growth of roots and, to some degree, the movement of water.

Included with this soil are small areas of Cieneba and Sheridan soils. In a few areas these included soils are near areas of calcareous sandstone and shale, and in these areas they may contain alkaline or calcareous material beneath the subsoil.

This soil has low to moderate fertility. Permeability is moderate, and runoff is medium to rapid. The hazard of erosion is moderate to severe, but the soil is generally slightly eroded. Available water holding capacity is about 6 to 8 inches.

This soil is used for dryland pasture. Capability unit VIe-1 (15); pasture and range site 3.

Auberry fine sandy loam, 30 to 75 percent slopes, eroded (AuG2).—This soil is similar to Auberry fine sandy loam, 15 to 30 percent slopes, but it is steep to very steep, is moderately eroded, and has a thinner profile. Slopes are dominantly 45 to 60 percent. The vegetation consists of grasses and forbs and a moderately thick stand of oaks and Digger pine. The more eroded areas are covered mostly with brush and some oaks and pines.

Included with this soil are some soils that have a less clayey subsoil and small areas of soils that are severely eroded.

Runoff is rapid to very rapid, and the hazard of erosion is severe to very severe. Available water holding capacity is about 4 to 7 inches.

This soil is used for range, recreation, wildlife, and watersheds. Capability unit VIIe-1 (15); pasture and range site 3.

Badland

Badland (BaG) consists of steep to very steep areas where soft geologic material has been exposed by accelerated erosion or where erosion and gullying have been very severe (fig. 3). Talus slopes at the base of the steeper slopes are also part of this land type. Except for thin low brush in a few areas, there is little or no vegetation on this land. As a result, runoff is rapid, and siltation is high.

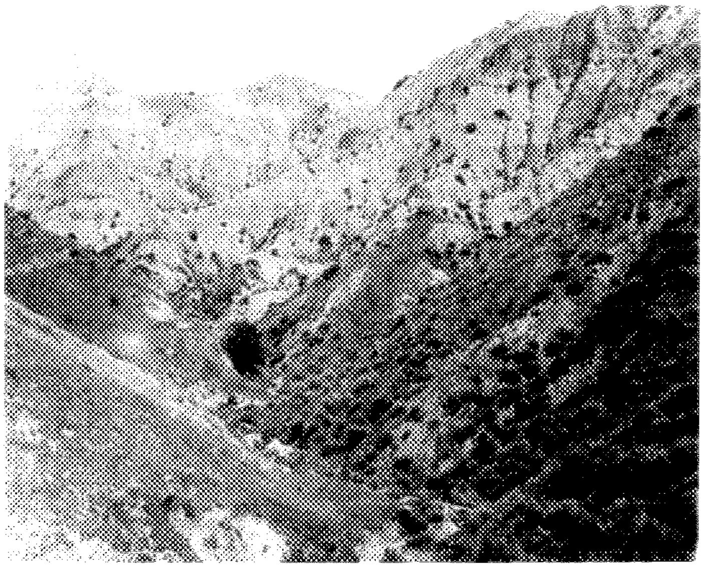

***Figure 3.*—An area of Badland. Soft geologic material has been exposed by erosion.**

Included in mapping were small areas of very thin soils and small areas of soils similar to the surrounding soils. These included areas provide limited grazing.

This land type is used for watersheds and for wildlife. Many areas are steep enough to bar the movement of livestock. Capability unit VIIIe-1 (15).

Botella Series

The Botella series consists of well-drained loamy soils that are underlain by stratified alluvium at a depth of more than 60 inches. These soils are nearly level to sloping and lie on flood plains and fans in the smaller valleys. The vegetation consists of annual grasses, forbs, and scattered oaks. Botella soils are less than 800 feet above sea level. Annual rainfall ranges from 14 to 20 inches, average annual temperature is 60° F., and the frost-free period is about 260 days. The main associated soils are the Clear Lake, Pleasanton, and Yolo.

The surface layer is gray to grayish-brown loam 12 to 16 inches thick. Color ranges from gray or dark grayish brown to grayish brown. The subsoil is dark grayish-brown to dark-gray clay loam that is about 28 inches thick. The texture of both the surface layer and subsoil ranges from loam to clay loam. As much as 30 inches of pale-brown and brown clay loam occurs in places between the subsoil and the underlying stratified alluvium.

Botella soils are used mostly for dryland grain and incidental pasture.

Botella loam, 0 to 2 percent slopes (BoA).—This soil occurs along drainageways in the smaller valleys.

Representative profile: On McCreary Ranch, in a field on bottom lands one-fourth mile east of ranchhouse.

Ap—0 to 10 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) when moist; moderate, fine, granular structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, fine and medium, interstitial pores; medium acid; clear, smooth boundary.

A3—10 to 16 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; many, very fine, fine, and medium, tubular pores; slightly acid; clear, smooth boundary.

B21t—16 to 28 inches, dark grayish-brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few very fine and fine roots; few, very fine and fine, tubular pores; thin patchy clay films on surface; of peds and in larger pores; few weathered fragments of fine-grained sandstone; neutral; gradual, smooth boundary.

B22t—28 to 44 inches, dark-gray (10YR 4/1) clay loam, black (10YR 2/1) when moist; weak, fine, angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few, very fine and fine, tubular pores; few, thin, patchy clay films on the surfaces of peds and larger pores; few weathered fragments of fine-grained sandstone; neutral; gradual, smooth boundary.

C1—44 to 72 inches, pale-brown and brown (10YR 6/3, 5/3) clay loam, variegated light gray and dark gray (10YR 6/1, 4/1) when moist; weak, medium, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few, very fine, tubular pores; neutral; gradual, smooth boundary.

IIC2—72 to 84 inches +, light yellowish-brown (10YR 6/4) gravelly clay loam; neutral.

Included with this soil are small areas of Yolo and Cotati soils. Also included are small areas of moderately well drained soils.

This soil is highly fertile. Available water holding capacity is 10 to 12 inches. Permeability is moderately slow, runoff is very slow, and the hazard of erosion is slight to none. The root zone is very deep.

This soil is used for dryland grain and incidental pasture. Capability units I-1 (14) and IIIc-1 (15).

Botella loam, 2 to 9 percent slopes (BoC).—This soil is similar to Botella loam, 0 to 2 percent slopes, but it is slightly steeper. It lies in narrow valleys or on fans in the larger valleys of the uplands. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for dryland grain and incidental pasture. Capability units IIe-1 (14) and IIIe-1 (15).

Cibo Series

The Cibo series consists of well-drained clayey soils that are underlain by fine-grained basic igneous rock at a depth of 18 to 40 inches. These soils are moderately steep to very steep and lie on hilly to mountainous uplands. The vegetation consists chiefly of annual grasses and forbs and some scattered oaks and brush on the more eroded rocky slopes. Cibo soils are 1,500 to 4,000 feet above sea level. Annual rainfall ranges from 14 to 20 inches. The average annual temperature is about 62° F., and the average frost-free period is about 280 days. The main associated soils are the Vallecitos and Gaviota.

The surface layer is dark-brown stony or rocky clay 10 to 25 inches thick. The upper part of this layer ranges from clay to clay loam. The next layer is brown very stony clay 8 to 15 inches thick. This layer is dominantly brown but ranges to reddish brown. Underlying this layer is fine-grained, pinkish-gray and gray basic igneous bedrock. The depth to bedrock and the number of stones in the profile vary.

Cibo soils are used for pasture, range, watersheds, wildlife, and recreation.

Cibo stony clay, 15 to 50 percent slopes, eroded (CbF2)—This soil is on rounded hills or side slopes in areas of steep to very steep soils.

Representative profile: On Quien Sabe Ranch, on main road to feed mill, three-quarters mile northeast of ranch headquarters, on hillside above road, 400 yards west of lake.

A11—0 to 9 inches, dark-brown (7.5YR 4/2) stony clay, dark brown (7.5YR 3/2) when moist; strong, fine, granular structure in top ½ inch to 2 inches and moderate, fine, subangular blocky structure below; hard when dry, firm when moist, very sticky and very plastic when wet; abundant very fine and fine roots; few, very fine, tubular pores and common, fine, interstitial pores; slightly acid; gradual, smooth boundary.

A12—9 to 25 inches, dark-brown (7.5YR 4/2) stony clay, dark brown (7.5YR 3/2) when moist; moderate, coarse, subangular blocky structure; hard when dry, firm when moist, very sticky and very plastic when wet; few very fine and fine roots; few, very fine, tubular and interstitial pores; many fine slickensides; neutral clear, smooth boundary.

C—25 to 37 inches, brown (7.5YR 5/4) very stony clay, dark brown (7.5YR 4/4) when moist; moderate, fine, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; few very fine roots; common, very fine, tubular pores; many fine slickensides; mildly alkaline; gradual, irregular boundary.

R—37 inches, pinkish-gray (7.5YR 7/2) and gray (N 6/0), fractured and weathered, hard, fine-grained basic igneous rock; mildly alkaline.

The soil is slightly to moderately eroded, but small areas are severely eroded. This soil is typically stony, and rocks crop out in some places.

Included with this soil are small areas of Vallecitos and Gaviota soils. This soil is low in fertility. Available water holding capacity is 4 to 6 inches. Permeability is slow, runoff is medium to rapid, and the hazard of erosion is moderate to severe. The root zone is moderately deep.

This soil is used for dryland pasture. Capability unit VIs-5 (15); pasture and range site 5.

Cibo rocky clay, shallow, 15 to 75 percent slopes, eroded (CcG2).—This soil is similar to Cibo stony clay, 15 to 50 percent slopes, eroded, but it is more shallow to bedrock and is rocky. It occupies somewhat angular hilly and mountainous areas. The depth to fractured rock ranges from 18 to 24 inches. Slopes are dominantly 45 to 60 percent. The soil is generally moderately eroded but is severely eroded on some steeper slopes.

Included with this soil in mapping are some small to moderate areas of very rocky soils, rock outcrops, very thin soils, and severely eroded soils.

Runoff is medium to very rapid, and the hazard of erosion is moderate to very severe. Available water holding capacity is 2.5 to 4 inches.

This soil is used for range, watersheds, wildlife, and recreation. Capability unit VIIs-1 (15); and pasture and range site 5.

Cieneba Series

The Cieneba series consists of somewhat excessively drained to excessively drained loamy soils that are underlain by strongly weathered granite at a depth of 18 inches or less. These soils are moderately steep to very steep and occupy mountainous uplands. The vegetation consists mainly of thin to thick stands of brush, scattered oaks and Digger pine, and a few areas of sparse grass. Elevations are 1,500 to 3,000 feet above sea level. Annual rainfall ranges from 14 to 20 inches, average annual temperature is about 60° F., and the frost-free period is about 240 days. The main associated soils are the Auberry and Sheridan.

The surface layer, 8 to 18 inches thick, is pale-brown gravelly sandy loam in most places but ranges from gravelly loam to coarse sandy loam. In some areas of dense brush, a thin layer of partly decomposed organic matter covers the surface. The underlying granite is strongly and deeply weathered. It somewhat limits the movement of water, and it limits the penetration of roots to fractures in rocks. Depth to weathered granite ranges from 8 to 18 inches.

Cieneba soils are used for range, watersheds, wildlife, and recreation.

Cieneba gravelly sandy loam, 15 to 75 percent slopes, severely eroded (CgG3).—This soil is on narrow pointed ridges.

Representative profile: On Fremont Peak Road, 9 miles from San Juan Bautista, on ridge to south of road, under brush cover.

01—½ inch to 0, grayish-brown, (10YR 5/2) intermittent, partly decomposed leaf and twig litter; loose and fluffy; abrupt, smooth boundary.

A1—0 to 10 inches, pale-brown (10YR 6/3) gravelly sandy loam, dark brown (10YR 4/3) when moist; moderate, fine, granular structure; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; abundant fine and medium roots; many, very fine and fine, interstitial pores; medium acid; gradual, smooth boundary.

C—10 inches, reddish-yellow (7.5YR 6/6) and brown (10YR 5/3) strongly weathered, acid granitic material with relic rock structure; some loam in cracks and cleavage planes; larger roots penetrate easily and deeply; grades into hard granite at an undetermined depth.

Small to moderate amounts of relatively unweathered granite and fine-grained igneous rock crop out in most areas.

Included with this soil are small areas of Auberry and Sheridan soils. Also included are a few small areas that are reddish-yellow to yellowish-brown loam to clay.

This soil has low fertility. Available water holding capacity is about 1 to 2 inches. Permeability is rapid, runoff is medium to very rapid, and the hazard of erosion is moderate to very severe. Roots penetrate as deep as the strongly weathered granite.

This soil is used for wildlife, watersheds, and recreation. Capability unit VIIIs-1 (15).

Cieneba gravelly sandy loam, 30 to 75 percent slopes, eroded (CgG2).—This soil is similar to Cieneba gravelly sandy loam, 15 to 75 percent slopes, severely eroded, but it is only moderately eroded and is 10 to 18 inches deep to weathered granite. It occupies narrow, pointed, winding ridges or very steep side slopes in areas of Sheridan soils. Slopes are dominantly 30 to 65 percent. Included with this soil are some slightly deeper soils that have slopes of 15 to 30 percent. Also included are a few small areas of limestone or marble in the mountains to the west of Cienega Road.

Available water holding capacity is 2 to 3 inches. Runoff is rapid to very rapid, and the hazard of erosion is severe to very severe.

This soil is used mostly for watershed, wildlife and recreation, but some areas provide limited grazing. Capability unit VIIe–4 (15); pasture and range site 3.

Clear Lake Series

The Clear Lake series consists of poorly drained soils that are clayey in most places and formed in alluvium that washed from sedimentary rocks. These soils are nearly level and occupy low-lying flood plains and valley bottoms. The vegetation is annual grasses and forbs. Clear Lake soils are 130 to 1,500 feet above sea level. Annual rainfall ranges from 12 to 16 inches, average annual temperature is about 60° F., and the frost-free period is about 250 days. The main associated soils are the Cropley, Pacheco, Sorrento, and Willows.

The surface layer is very dark gray to dark-gray clay or silty clay loam 24 to 40 inches thick. The next layer is light brownish-gray clay 10 to 20 inches thick. Below this is gray clay that is underlain by stratified calcareous alluvium in some places. The alluvium extends to depths greater than 5 feet. Most areas of Clear Lake soils show some degree of stratification in the underlying material. Many areas have one or more buried horizons at depths greater than 50 inches.

Clear Lake soils are used for irrigated vegetables, sugar beets, tomatoes, apricots, prunes, walnuts, and alfalfa and for dryland grain and pasture.

Clear Lake clay (0 to 2 percent slopes) (Ch).—This soil lies on valley bottoms on slopes of 1 percent or less.

Representative profile: On Vierra Ranch, 3 miles east of the junction of San Felipe Road and State Route 156; by fence in alfalfa field.

Ap—0 to 12 inches, very dark gray (2.5Y 3/0) clay, black (2.5Y 2/0) when moist; strong, fine, granular structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; abundant very fine and fine roots, few medium roots; common, very fine and fine, interstitial pores; mildly alkaline; clear, smooth boundary.

A1—12 to 30 inches, dark-gray (10YR 4/1) clay, black (10YR 2/1) when moist; strong, medium, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; plentiful very fine and fine roots; common, very fine and fine, tubular pores; many fine and medium slickensides; common, coarse, black (2.5Y 2/0) organic stainings on ped surfaces; moderately alkaline, slightly effervescent; clear, smooth boundary.

C1—30 to 40 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) when moist; moderate, coarse, subangular blocky structure; very hard when dry, firm when moist, very sticky and very plastic when wet; many, very fine and fine, tubular pores; common, medium, very dark gray (2.5Y 3/0) organic stains on surfaces of peds and larger pores; moderately alkaline, slightly effervescent; clear, smooth boundary.

C2g—40 to 70 inches, gray (5Y 6/1) clay, gray (5Y 5/1) when moist; many, fine, distinct, light yellowish-brown (2.5Y 6/4) mottles, light olive brown (2.5Y 5/4) when moist; moderate, coarse, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; many, very fine and fine, tubular pores; few, medium, very dark gray (2.5Y 3/0) organic stains on surfaces of peds and larger pores; moderately alkaline, strongly effervescent; clear, smooth boundary.

This soil is highly fertile. Available water holding capacity is about 8 to 10 inches. Permeability is slow, runoff is ponded to very slow, and the hazard of erosion is none to slight. The root zone is deep.

Most areas of this soil have been drained and are used for irrigated row crops and apricots. Dryland barley is grown in some areas. Capability unit IIs–5 (14).

Clear Lake clay, saline (0 to 2 percent slopes) (Ck).—This soil is similar to Clear Lake clay, but it contains slight to moderate amounts of salts and alkali. This soil occurs in low-lying valley bottoms. Included with this soil are some areas that have a dark-gray to dark grayish-brown heavy clay loam surface layer.

This soil is used for irrigated sugar beets and alfalfa and for dryland grain and pasture. Capability unit IIIw–5 (14); pasture and range site 11.

Clear Lake silty clay loam (0 to 2 percent slopes) (Cl).—This soil occurs in small valleys in the uplands or in small areas in the larger valleys. It has a calcareous silty clay loam surface layer and a seasonally high or continuously high water table. Included with this soil are soils that have a clay surface layer, soils that are somewhat poorly drained, and soils that have a grayish-brown surface layer.

The soil is used for dryland barley and incidental pasture. Capability unit IIIw–5 (15).

Climara Series

The Climara series consists of well-drained clayey soils underlain by serpentine or serpentinized rocks at a depth of about 3 to 4 feet. These soils are strongly sloping to steep and are on uplands. The vegetation is chiefly annual grasses and forbs, but the steeper slopes are covered by thin to moderately thick stands of oaks and Digger pines. Many eroded areas are covered with brush. Elevations range from 500 to 3,000 feet above sea level. Annual rainfall is 10 to 16 inches, average annual temperature is about 60° F., and the frost-free period is about 250 days. The main associated soils are the Vallecitos, Gazos, Henneke, and Montara.

The surface layer is gray clay 21 to 31 inches thick. The next layer is light yellowish-brown gravelly clay 7 to 12 inches thick. In most places weathered rock occurs at a depth of 28 and 43 inches.

Climara soils are used for dryland grain and pasture.

Climara clay, 9 to 15 percent slopes (CmD).—This soil occurs on rounded ridgetops within areas of steeper soils or in other small areas.

Representative profile: On Tully Ranch, 10 yards south of ranch road, three-quarter mile east of State Route 25.

A11—0 to 12 inches, gray (5Y 5/1) clay, very dark gray (5Y 3/1) when moist; strong, very fine, granular structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; abundant very fine and fine roots; few, very fine and fine, tubular pores; neutral; gradual, smooth boundary.

A12—12 to 28 inches, gray (5Y 5/1) clay, very dark gray (5Y 3/1) when moist; strong, fine, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; plentiful very fine roots; few, very fine, tubular pores; many, small, medium and coarse slickensides; mildly alkaline, slightly effervescent; gradual, smooth boundary.

Cca—28 to 36 inches, light yellowish-brown (2.5Y 6/4)) gravelly clay, olive brown (2.5Y 4/4) when moist; moderate, fine, subangular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; few very fine roots; few, very fine and fine, tubular pores; common small seams and soft masses of lime; moderately alkaline, strongly effervescent; gradual, irregular boundary.

R—36 inches, weathered, highly fractured, fine-grained, greenish-gray serpentine rock.

In places bedrock is near enough to the surface to interfere with the penetration of roots.

Included with this soil are small areas of Diablo, Henneke, and Montara soils. Also included are areas of rock outcrop.

This soil has moderate to low fertility. Available water holding capacity is 5 to 7 inches. Runoff is medium, permeability is slow, and the hazard of erosion is moderate. The root zone is moderately deep to deep.

This soil is used for dryland grain and pasture. Capability unit IIIe-5 (15); pasture and range site 1.

Climara clay, 15 to 50 percent slopes, eroded (CmF2).—This soil is similar to Climara clay, 9 to 15 percent slopes, but it is steeper and has a thinner surface layer. It is generally moderately eroded, but some steeper areas and slopes along drainageways are severely eroded. The more eroded areas have a cover of brush, oaks, and pines, but some are bare. This soil is commonly 28 to 34 inches deep over bedrock, but depth ranges from 20 to 60 inches. A small to large number of rock fragments occur throughout the profile.

Included with this soil are some areas of Landslides that have an uneven hummocky surface.

This soil has low to moderate fertility. Available water holding capacity is 3 to 5 inches, runoff is medium to rapid, and the hazard of erosion is moderate to severe.

This soil is used mainly for pasture, and some small areas are in dryland grain. Capability unit VIe-5 (15); pasture and range site 1.

Cometa Series

The Cometa series consists of well-drained soils underlain by granitic alluvium. These soils have a loamy surface layer and a clayey subsoil. They are gently sloping to strongly sloping and occupy terraces and toe slopes. The vegetation is annual grasses, forbs, and some Digger pines and oaks. Elevations are 800 to 1,600 feet above sea level. Annual rainfall is 12 to 18 inches, average annual temperature is about 62° F., and the frost-free period is about 250 days. The main associated soils are the Hanford, Auberry, and Sheridan.

The surface layer is brown sandy loam or loam about 18 inches thick. The subsoil, 24 to 36 inches thick, is reddish-brown clay that grades to coarse sandy clay loam in the lower part. The substratum is reddish-yellow coarse sandy loam that extends to depths greater than 5 feet.

Cometa soils are used for dryland pasture and grain.

Cometa sandy loam, 5 to 15 percent slopes, eroded (CoD2).—This soil is on toe slopes and on small terraces in small valleys of the uplands.

Representative profile: On Lonoak Road, 4 miles west of State Route 25, west of road.

A11—0 to 10 inches, brown (10YR 5/3) sandy loam, dark grayish brown to very dark grayish brown (10YR 4/2, 3/2) when moist; moderate, fine, granular structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, very fine, tubular pores and common, fine, interstitial pores; medium acid; clear, smooth boundary.

A12—10 to 18 inches, brown (7.5YR 5/4) sandy loam, brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, very fine and fine, tubular pores; medium acid; clear, smooth boundary.

B21t—18 to 38 inches, reddish-brown (5YR 4/4) clay, reddish brown (5YR 4/4) when moist; strong, coarse, prismatic structure that breaks readily into moderate, medium, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few very fine and fine roots; few, very fine and fine, tubular pores; thin continuous clay films and thick, patchy, dark reddish-brown (5YR 3/3) clay films on surfaces of peds and pores; slightly acid; gradual, smooth boundary.

B22t—38 to 50 inches, reddish-brown (5YR 5/4) coarse sandy clay loam, reddish brown (5YR 4/4) when moist; moderate, medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; few very fine and fine, tubular pores; few, thin, patchy clay films on ped surfaces; neutral; gradual, smooth boundary.

C—50 to 80 inches, reddish-yellow (5YR 6/6) coarse sandy loam, yellowish red (5YR 4/6) when moist; weak, coarse, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few, very fine, tubular pores; mildly alkaline.

Included with this soil are soils that have a less clayey subsoil.

This Cometa soil has low fertility. Available water holding capacity is 3 to 4 inches. Permeability is very slow, runoff is medium, and the hazard of erosion is moderate. Some areas are severely eroded, and areas on the steeper slopes are gullied in some places. The root zone is shallow.

The soil is used for dryland pasture and grain. Capability unit IVe-3 (15); pasture and range site 4.

Cometa loam, 5 to 15 percent slopes, eroded (CnD2).—This soil is similar to Cometa sandy loam, 5 to 15 percent slopes, eroded, but it has a surface layer that consists of loam instead of sandy loam. It occurs on toe slopes and small terraces in small valleys and depressions in the uplands.

Included with this soil are some slightly eroded, gently sloping soils.

This soil has available water holding capacity of 4 to 6 inches. Runoff is medium, and the hazard of erosion is moderate. The root zone is shallow.

This soil is used for dryland pasture and grain. Capability unit IVe-3 (15); pasture and range site 4.

Conejo Series

The Conejo series consists of well-drained loamy soils that are underlain by basic, igneous, alluvial material at a depth of 4½ to 6 feet. These soils are gently sloping to sloping and occupy fans and toe slopes. The vegetation consists chiefly of annual grasses and forbs and scattered oaks. Elevations range from 1,200 to 2,000 feet above sea level. The annual rainfall is 14 to 18 inches, average annual temperature is about 60° F., and the frost-free period is about 250 days. The main associated soils are the Edenvale and Cibo.

The surface layer is dark-gray to very dark gray clay loam 20 to 28 inches thick. The next layer is dark grayish-brown clay loam that extends to a depth of 55 inches or more. Below this is stratified, basic, igneous, alluvial material. The Conejo soils vary somewhat in texture and in the amount of gravel in the solum.

Conejo soils are used for dryland grain and incidental pasture.

Conejo clay loam, 2 to 9 percent slopes (CpC).—This soil occurs on toe slopes and fans between the valley bottoms and the uplands.

Representative profile: On main ranch road to Quien Sabe Ranch headquarters, 300 yards west of fork in road.

A11—0 to 2 inches, dark-gray (10YR 4/1) clay loam, black (10YR 2/1) when moist; moderate, fine, granular structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine roots; common, very fine, interstitial pores; neutral; clear, smooth boundary.

A12—2 to 7 inches, very dark gray (10YR 3/1) clay loam, black (10YR 2/1) when moist; moderate, fine, granular structure; hard when dry, friable when moist, sticky and plastic when wet; abundant very fine roots; common, very fine, interstitial pores; neutral; clear, smooth boundary.

A13—7 to 25 inches, very dark gray (10YR 3/1) clay loam, very dark gray (10YR 3/1) when moist; moderate, fine, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; abundant very fine roots; common, medium and coarse, tubular pores, common, very fine, interstitial and tubular pores; mildly alkaline; clear, smooth boundary.

C1—25 to 38 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; plentiful very fine roots; few, very fine, interstitial and tubular pores, common, medium and coarse, interstitial pores; mildly alkaline; gradual, smooth boundary.

C2—38 to 55 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; weak subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; few very fine roots; common, very fine, interstitial and tubular pores; mildly alkaline.

Included with this soil are small areas of the Edenvale soils.

This soil is moderately fertile. Available water holding capacity is 10 to 12 inches. Permeability is moderately slow, runoff is slow to medium, and the hazard of erosion is slight to moderate. Water from surrounding hills has cut gullies in a few included areas. The root zone is very deep.

This soil is used for dryland grain and incidental pasture. Capability unit IIIe-5 (15).

Corralitos Series

The Corralitos series consists of somewhat excessively drained sandy soils that are underlain by stratified alluvial sand at a depth of 42 to 60 inches. These soils are on fans and are gently sloping to sloping. The vegetation consists mainly of annual grasses and forbs and areas of brush, eucalyptus, and fern. Elevations range from 200 to 800 feet. Annual rainfall is 16 to 20 inches, average annual temperature is about 59° F., and the frost-free period is about 260 days. The main associated soils are the Arnold, Pinto, and Cotati.

The surface layer, about 20 inches thick, (fig. 4) is brown loamy sand in most places, but it ranges from brown to grayish brown. The next layer is pale-brown loamy sand about 22 inches thick. Below this is light yellowish-brown stratified alluvial sand.

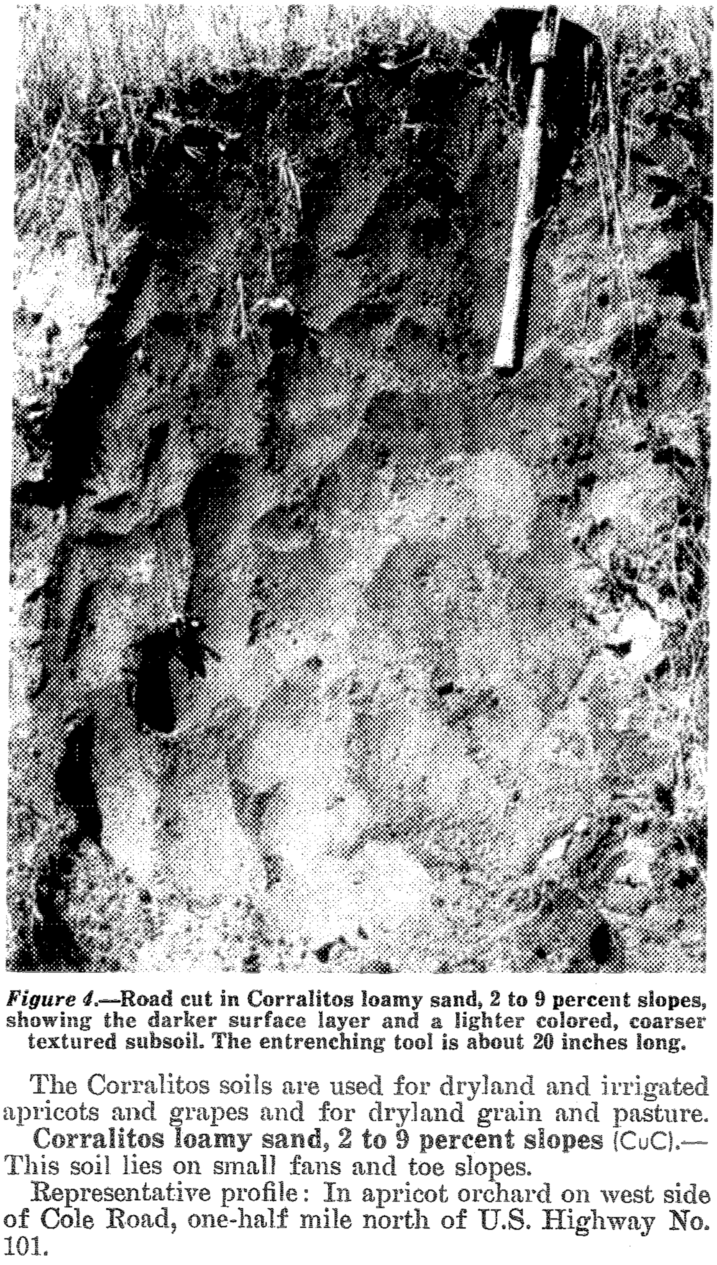

Figure 4.—**Road cut in Corralitos loamy sand, 2 to 9 percent slopes, showing the darker surface layer and a lighter colored, coarser textured subsoil. The entrenching tool is about 20 inches long.**

The Corralitos soils are used for dryland and irrigated apricots and grapes and for dryland grain and pasture.

Corralitos loamy sand, 2 to 9 percent slopes (CuC).—This soil lies on small fans and toe slopes.

Representative profile: In apricot orchard on west side of Cole Road, one-half mile north of U.S. Highway No. 101.

Ap—0 to 8 inches, brown (10YR 5/3) loamy sand, dark brown (10YR 3/3) when moist; single grain; loose when dry, nonsticky and nonplastic when wet; plentiful very fine and fine roots; strongly acid; clear, smooth boundary.

A1—8 to 20 inches, brown (10YR 5/3) loamy sand, dark brown (10YR 3/3) when moist; single grain; loose when dry, nonsticky and nonplastic when wet; few very fine, fine, and coarse roots; strongly acid; gradual, smooth boundary.

C1—20 to 42 inches, pale-brown (10YR 6/3) loamy sand, brown (10YR 4/3) when moist; single grain; loose when dry, nonsticky and nonplastic when wet; few coarse roots; stratified; strongly acid; clear, smooth boundary.

C2—42 to 84 inches +, light yellowish-brown (10YR 6/4) stratified sand, dark yellowish brown (10YR 4/4) when moist; single grain; loose when dry, nonsticky and nonplastic when wet; strongly acid.

Included with this soil are some small areas of Arnold soils and of some soils that have a sandy loam surface layer.

This soil has low fertility. Permeability is rapid, and runoff is very slow. The hazard of erosion is slight to none, but in some included areas water from surrounding hills has cut gullies. Available water holding capacity is about 4 to 5 inches. The root zone is very deep.

This soil is used for dryland and irrigated apricots, grapes, grain, and pasture. Capability unit IIIs-4 (14).

Cotati Series

The Cotati series consists of moderately well drained soils that formed in alluvium derived from many kinds of rocks. These soils have a loamy surface layer and a clayey subsoil. They are on terraces and are gently sloping to moderately steep. The vegetation consists mostly of annual grasses and forbs and scattered oaks. Elevations range from 200 to 800 feet above sea level. Annual rainfall is 16 to 20 inches, average annual temperature is about 60° F., and the frost-free period is about 260 days. The main associated soils are the Arnold, Los Gatos, Soper, and Sween.

The surface layer is grayish-brown to gray loam 16 to 24 inches thick. The subsoil is brown clay 14 to 20 inches thick. The upper part of the substratum is light yellowish-brown coarse sandy clay loam about 4 to 10 inches thick. It overlies gravelly sandy loam alluvium that extends to an undetermined depth and is commonly brittle and compact in place. In some places a few fine pebbles are in the surface layer and moderate amounts are in the subsoil.

The Cotati soils are used for pasture.

Cotati loam, 9 to 15 percent slopes, eroded (CvD2).—This soil occurs on dissected terraces.

Representative profile: On Nyland Ranch, one-quarter mile southeast of junction of State Route 156 and U.S. Highway No. 101, 50 yards east of State Route 156.

A1—0 to 14 inches, grayish-brown (10YR 5/2) loam, dark yellowish brown (10YR 3/4) when moist; weak, fine, subangular blocky structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, very fine and fine, tubular pores, common, fine and medium, interstitial pores; strongly acid; clear, smooth boundary.

A2—14 to 17 inches, gray (10YR 6/1) loam, gray (10YR 5/1) when moist; weak, fine, subangular blocky structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, very fine and fine, tubular pores, common, fine and medium, interstitial pores; strongly acid; abrupt, smooth boundary.

B2t—17 to 31 inches, brown (10YR 5/3) sandy clay, brown (10YR 4/3) when moist; strong, coarse, columnar structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; few very fine roots; few, very fine and fine, tubular pores; thin continuous clay films on surfaces of peds and pores; common slickensides that are fine, medium, and coarse; strongly acid; clear, smooth boundary.

C1—31 to 35 inches, light yellowish-brown (2.5Y 6/4) coarse sandy clay loam, light olive brown (2.5Y 5/4) when moist; weak, fine, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few very fine roots; few, fine, interstitial pores; brown organic stains on larger ped surfaces; strongly acid; clear, smooth boundary.

IIC2—35 to 50 inches, olive-brown gravelly sandy loam, brittle and compact; strongly acid.

Figure 5 shows a profile of Cotati loam, 9 to 15 percent slopes, eroded.

Included with this soil are small areas of Antioch soils. Also included are some soils that are moderately alkaline and calcareous in the substratum.

This soil has low fertility. Available water holding capacity is 2.5 to 4.5 inches. Permeability is very slow, and runoff is medium to rapid. The hazard of erosion is moderate to severe, and small included areas are severely eroded. The root zone is shallow.

The soil is used for dryland pasture. Capability unit VIe-3 (15); pasture and range site 4.

Cotati loam, 2 to 9 percent slopes (CvC).—This soil is similar to Cotati loam, 9 to 15 percent slopes, eroded, but it has a thicker surface layer, is less sloping, and is only slightly eroded. It occurs on high terraces or along small drainageways in areas south of the Flint Hills and west of San Juan Bautista. Slopes are dominantly 2 to 6 percent.

Included with this soil are a few small areas that have a sandy loam or clay loam surface layer. Also included are some soils that have a thicker surface because they receive material from higher areas.

This soil has low to moderate fertility. Available water holding capacity is 3.0 to 4.5 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

The soil is used for dryland pasture. Capability unit IVe-3 (15); pasture and range site 4.

Cotati loam, 15 to 30 percent slopes, eroded (CvE2).—This soil is similar to Cotati loam, 9 to 15 percent slopes, eroded, but it is more sloping and has a thinner surface layer. Slopes are dominantly 20 to 25 percent. The surface layer is generally grayish brown but ranges to light brownish gray in a few places. In a few areas as much as 1 or 2 percent of the surface layer is fine gravel. Included with this moderately eroded soil are a few severely eroded areas.

Runoff is rapid. The hazard of erosion is severe.

This soil is used for dryland pasture. Capability unit VIe-3 (15); pasture and range site 4.

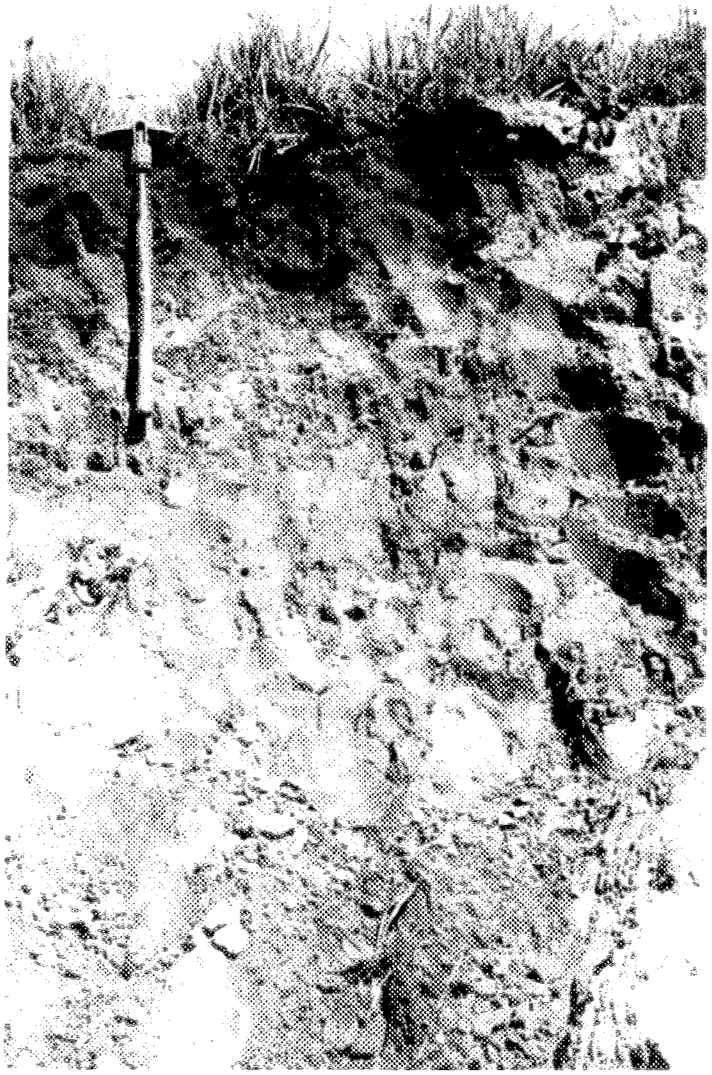

Figure 5.—**Road cut through Cotati loam, 9 to 15 percent slopes, eroded. This soil has a dark-colored surface layer, a leached layer, and a sandy clay subsoil. The sandy clay subsoil severely limits the growth of roots and the penetration of water. The entrenching tool is about 20 inches long.**

Cropley Series

The Cropley series consists of well-drained clayey soils that are underlain by coarser textured material at depths greater than 40 inches. These soils are nearly level to sloping and occupy fans and terraces. The vegetation consists of annual grasses and forbs and scattered oaks. Elevations range from 130 to 1,500 feet above sea level. Annual rainfall is 12 to 14 inches, average annual temperature is about 59° F., and the frost-free period is about 260 days. The main associated soils are the Clear Lake, Sorrento, and Willows.

The surface layer is very dark gray to dark grayish-brown clay or silty clay loam that is about 32 inches thick. The next layer is grayish-brown clay that ranges from 10 to 15 inches in thickness. Below this is grayish-brown sandy clay loam that is underlain by stratified sand, gravel, and clay in some places. These stratified materials extend to depths greater than 5 feet. The content of lime below the surface layer varies.

The Cropley soils are used for irrigated fruit and nuts, vegetables, grapes, sugar beets, tomatoes, and alfalfa and for dryland grain and incidental pasture.

Cropley clay, 2 to 9 percent slopes (CwC).—This soil is on long gently sloping fans or is in gently rolling areas.

Representative profile: On O'Connell Ranch, one-half mile northwest of house and 1 mile southwest of railroad.

Ap—0 to 6 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; strong, fine, granular structure; hard when dry, firm when moist, very sticky and very plastic when wet; abundant very fine and fine roots; few, very fine and fine, tubular pores; few, medium and coarse, interstitial pores; neutral; clear, smooth boundary.

A11—6 to 20 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; moderate, fine, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; abundant very fine and fine roots; few, very fine and fine, tubular pores; few small pebbles; common fine and medium slickensides; moderately alkaline; gradual, smooth boundary.

A12—20 to 32 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; moderate, medium, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; few very fine and fine roots; few, very fine and fine, tubular pores, few, fine and medium, interstitial pores; few small pebbles; common fine and medium slickensides; moderately alkaline, slightly effervescent; gradual, smooth boundary.

C1—32 to 42 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, firm when moist, very sticky and very plastic when wet; few very fine and fine roots; few, fine and medium, tubular pores, few, medium, interstitial pores; few small pebbles; moderately alkaline, strongly effervescent; gradual, smooth boundary.

C2—42 to 65 inches, grayish-brown (2.5Y 5/2) sandy clay loam, dark grayish brown (2.5Y 4/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, firm when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; common, fine and medium, tubular pores, common, fine and medium, interstitial pores; moderately alkaline, slightly effervescent.

Included with this soil are small areas of Clear Lake and Willows soils.

This soil is fertile. Available water holding capacity is 8 to 10 inches. Permeability is slow, runoff is slow to medium, and the hazard of erosion is slight to moderate. In a few included areas, water from surrounding hills has cut gullies. The root zone is very deep.

The soil is used for irrigated fruits, nuts, sugar beets, tomatoes, grapes, and vegetables, for dryfarmed grain, and for incidental pasture. Capability units IIe-5 (14) and IIIe-5 (15).

Cropley clay, 0 to 2 percent slopes (CwA).—This nearly level soil is similar to Cropley clay, 2 to 9 percent slopes, but the surface layer contains coarse gravel in some areas. Also, the underlying material is somewhat stratified and contains strata of fine to medium gravel in some places. Included with this soil are small areas of somewhat poorly drained soils.

Runoff is very slow and is ponded in small areas during winter. The hazard of erosion is slight to none.

This soil is used for irrigated fruits, nuts, grapes, alfalfa, sugar beets, and tomatoes and for dryland grain and incidental pasture. Capability unit IIs-5 (14).

Cropley silty clay loam, 2 to 9 percent slopes (CyC).—This soil is similar to Cropley clay, 2 to 9 percent slopes, but it has a silty clay loam surface layer. It occurs in the Bolsa Area on long slopes that are dominantly 3 to 5 percent in most places. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included with this soil are soils that have a dark grayish-brown surface layer and soils that have a clay surface layer.

This soil is used for irrigated fruits, nuts, grapes, alfalfa, sugar beets, tomatoes, and vegetables and for incidental dryland pasture. Capability unit IIe-5 (14).

Diablo Series

The Diablo series consists of well-drained clayey soils that are underlain by calcareous soft sandstone and shale at depths greater than 30 inches. These soils are on hilly uplands and are strongly sloping to very steep. The vegetation consists of annual grasses and forbs and on the severely eroded slopes, scattered oaks and areas of brush. Elevations range from 400 to 2,000 feet. Annual rainfall is 12 to 16 inches, average annual temperature is 60° F., and the frost-free period is about 250 days. The main associated soils are the San Benito, Linne, and Soper.

In most places the surface layer is very dark gray clay 18 to 38 inches thick, but it ranges from clay to heavy clay loam (fig. 6). The next layer is dark grayish-brown to pale-olive clay 12 to 30 inches thick. Below this is stratified soft sediments or soft sandstone and shale. The depth to bedrock ranges from 30 to more than 60 inches. In some areas rock fragments, 2 to 10 inches in diameter, are interbedded between the lowest clay layer and the underlying sandstone.

These soils vary mainly in the amount of gravel and the content of lime in the profile. Because they crack deeply on drying, the upper part of the surface layer has granular structure.

The Diablo soils are used for dryland grain, chiefly barley, pasture, and range. A few small areas are irrigated and used for wine grapes.

Diablo clay, 15 to 30 percent slopes, eroded (DaE2).—This soil occurs on rounded hills and broad ridgetops.

Representative profile: On hillside to west of Cienega Road, at top of grade, 1 mile north of Bird Creek.

A11—0 to 8 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; strong, fine, granular structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; abundant very fine and fine roots; many, very fine and fine, interstitial pores; moderately alkaline; gradual, smooth boundary.

A12—8 to 26 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; strong, very fine, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; plentiful very fine and fine roots; few, very fine and fine, tubular pores; common fine slickensides; moderately alkaline, strongly effervescent; gradual, smooth boundary.

A13—26 to 38 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; common, coarse, distinct mottles of dark grayish-brown (2.5Y 4/2), very dark grayish brown (2.5Y 3/2) when moist; strong, fine, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; plentiful very fine and fine roots; common, very fine and fine, tubular pores; roots oriented along ped surfaces; common soft masses of lime; many slickensides that are fine, medium, and coarse; moderately alkaline, strongly effervescent; gradual, smooth boundary.

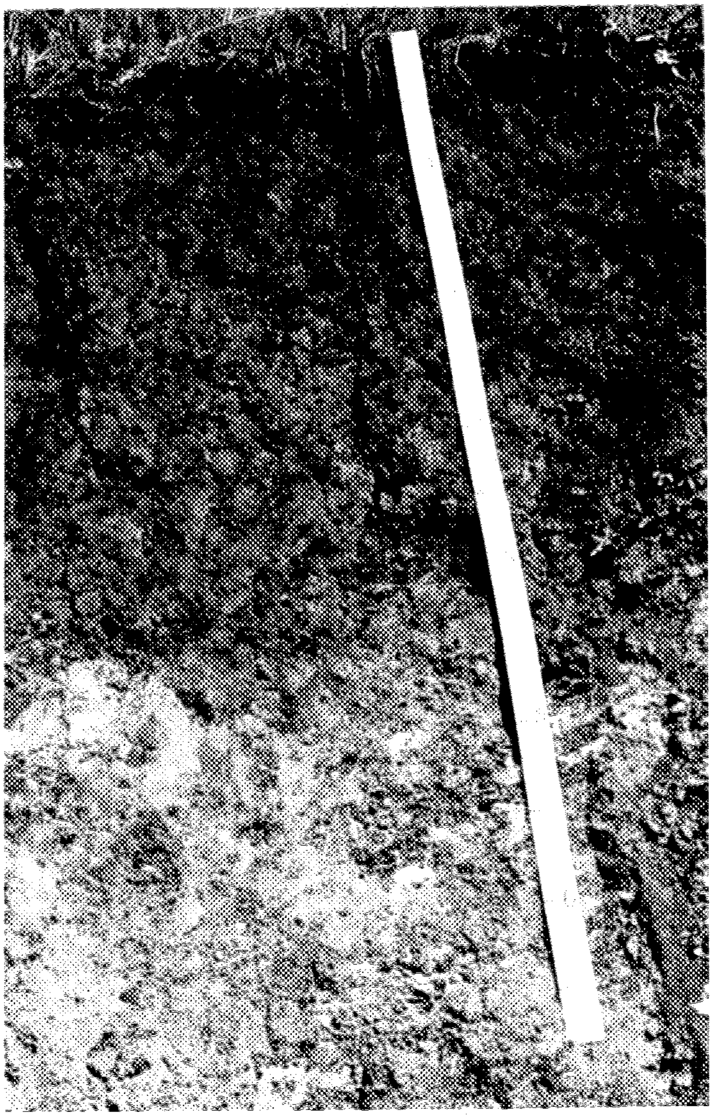

Figure 6.—**Diablo clay exposed in a road cut on Cienega Road, about 8 miles south of Hollister. A uniformly dark surface layer grades to lighter colored parent material at a depth of about 4½ feet.**

C1—38 to 52 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) when moist; common, coarse, faint mottles of light olive brown (2.5Y 5/4), olive brown (2.5Y 4/4) when moist; strong, fine, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; few very fine and fine roots; common, very fine and fine, tubular pores; common soft masses of lime; roots oriented along ped surfaces; many fine and medium slickensides; moderately alkaline, strongly effervescent; gradual, smooth boundary.

C2—52 to 68 inches, pale-olive (5Y 6/3) clay, olive (5Y 4/3) when moist; weak, fine, subangular blocky structure; hard when dry, firm when moist, very sticky and very plastic when wet; few, very fine and fine, tubular pores; common soft masses of lime and disseminated lime; moderately alkaline, strongly effervescent; gradual, smooth boundary.

R—68 inches, olive, highly weathered, calcareous, soft clay shale.

Under cultivation this soil is easily eroded and gullies form readily. Most areas are moderately eroded, but many of the steeper slopes are severely eroded, and a few areas are only slightly eroded.

Included with this soil are small areas of San Benito, Rincon, and Soper soils and of some soils that are calcareous throughout the profile. Also included are some large and many small Landslides.

This soil is highly fertile. Available water holding capacity is about 8 to 10 inches. Permeability is slow, runoff is rapid, and the hazard of erosion is severe. The root zone is deep to very deep.

The soil is used for dryland grain and pasture. Capability unit IVe–5 (15); pasture and range site 1.

Diablo clay, 9 to 15 percent slopes (DaD).—This soil is similar to Diablo clay, 15 to 30 percent slopes, eroded, but it has a thicker surface layer, is less sloping, and is only slightly eroded. It lies on low rolling hills or on toe slopes where the soil is somewhat thicker than typical. In a few areas, this soil has lime in the surface layer.

This soil has available water holding capacity of 10 to 12 inches. Runoff is medium, and the hazard of erosion is moderate. The root zone is very deep.

The soil is used for dryland grain and pastures. Capability unit IIIe–5 (15); pasture and range site 1.

Diablo clay, 30 to 50 percent slopes, eroded (DaF2).—This soil is similar to Diablo clay, 15 to 30 percent slopes, eroded, but it is steeper, has a thinner profile, and ranges from very dark gray to gray in the surface layer. This steep soil occurs in areas that are generally moderately steep and in more rugged areas that have narrow, winding ridgetops. Slopes are dominantly 45 to 50 percent. This soil is moderately eroded. Landslides are common, and the underlying material has been exposed by erosion in some areas, especially along drainageways and in areas of repeated slipping.

Included with this soil are small and large Landslides, some severely eroded areas, and Gullied land. Also included are small areas of San Benito soils.

Available water holding capacity is 6 to 8 inches. Runoff is rapid, and the hazard of erosion is severe. The root zone is moderately deep to deep.

This soil is used for dryland pasture and grain. Capability unit VIe–5 (15); pasture and range site 1.

Diablo clay, 50 to 75 percent slopes, severely eroded (DaG3).—This soil is similar to Diablo clay, 15 to 30 percent slopes, eroded, but it is steeper, has a thinner profile, and is severely eroded. Where the subsoil has been exposed by erosion, the color of the surface layer ranges from dark gray and grayish brown to yellowish brown. This soil occurs on hills where slopes are dominantly 60 percent. Rills and gullies are common.

Available water holding capacity is 4 to 6 inches. Runoff is very rapid, and the hazard of erosion is very severe. The root zone is moderately deep.

Range is the main use of this soil. Capability unit VIIe–5 (15); pasture and range site 1.

Diablo-Linne complex, 9 to 15 percent slopes (DlD).—This mapping unit is 60 percent Diablo clay, 9 to 15 percent slopes, and 40 percent Linne clay loam, 9 to 15 percent slopes. These soils occur on broad ridges that have strongly sloping side slopes. The Diablo soils generally occupy the gentle slopes, most of the north-facing slopes, and the saddles and drainageways. On these soils runoff is medium, and the hazard of erosion is moderate.

These soils are used mainly for pasture, but a few areas are in dryland grain. Capability unit IIIe–5 (15); pasture and range site 1.

Diablo-Linne complex, 15 to 30 percent slopes, eroded (DlE2).—This mapping unit generally is 50 percent Diablo clay, 15 to 30 percent slopes, eroded, and 50 percent Linne clay loam, 15 to 30 percent slopes, eroded. These soils occur on ridgetops or as areas of moderately steep soils. The Diablo soils generally occur on the more gentle slopes, the north-facing slopes, and around drainageways. Runoff is medium to rapid, and the hazard of erosion is moderate to severe.

Included in this complex are a few small Landslides and some severely eroded areas.

Pasture is the main use. Capability unit IVe–5 (15); pasture and range site 1.

Diablo-Linne complex, 30 to 50 percent slopes, eroded (DlF2).—This mapping unit is about 50 percent Diablo clay, 30 to 50 percent slopes, eroded, and 50 percent Linne clay loam, 30 to 50 percent slopes, eroded. These steep soils occur on side slopes, some of which are the side slopes of narrow, winding ridges. Dominant slopes range from 45 to 50 percent. Runoff is rapid, and the hazard of erosion is severe.

Included with this complex are small Landslides, severely eroded areas, and some outcrops of underlying material in very steep areas and on breaks. Also included are small areas of Shedd soils.

Pasture is the main use. Capability unit VIe–5 (15); pasture and range site 1.

Docas Series

The Docas series consists of well-drained, loamy soils that, at a depth of 4 to 5 feet, are underlain by stratified, calcareous silt loam alluvium. These soils are on flood plains and are nearly level to moderately sloping. Vegetation consists of annual grasses and forbs and a few oaks. Elevations range from 1,200 to 2,000 feet above sea level. Annual rainfall is 10 to 12 inches, average annual temperature is about 60° F., and the frost-free period is about 250 days. The main associated soils are the Panoche, Kettleman, Sorrento, and Shedd.

The surface layer is generally light-gray to light olive-gray silt loam or gray to dark-gray clay loam 10 to 16 inches thick. The next layer is gray to light-gray silt loam or clay loam 24 to 30 inches thick. It is underlain by light-gray silt loam that is stratified with thin lenses of sandy loam and clay loam.

Docas soils are used mostly for dryland pasture, but some small areas are used for dryland grain.

Docas silt loam, 0 to 2 percent slopes (DoA).—This soil occurs in upland valleys and along drainageways.

Representatives profile: On Ashurst Ranch in Vallecitos Valley, by a fence on south side of Ned Idria Road, 2 miles east of ranch house.

A11—0 to 5 inches, light-gray (5Y 7/2) silt loam, olive gray (5Y 5/2) when moist; moderate, thin, platy structure that breaks readily into moderate, fine, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, very fine and fine, tubular pores; moderately alkaline; strongly effervescent; clear, smooth boundary.

A12—5 to 11 inches, light olive-gray (5Y 6/2) silt loam, olive gray (5Y 4/2) when moist; weak, fine, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, very fine and fine, tubular pores; moderately alkaline; strongly effervescent; gradual, smooth boundary.

IIC1—11 to 36 inches, gray (5Y 6/1) silt loam, dark gray (5Y 4/1) when moist; weak, fine, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; common, very fine and fine, tubular pores; stratified; moderately alkaline; strongly effervescent; gradual, smooth boundary.

IIC2—36 to 88 inches, light-gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) when moist; weak, fine, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few, very fine and fine, tubular pores, thin strata of sandy loam and clay loam; moderately alkaline; strongly effervescent.

Included are small areas of Sorrento and Panoche soils. Also included are small areas of soils that lack a calcareous surface layer and some soils in which clay increases slightly in the subsoil.

This soil is moderately fertile. Available water holding capacity is about 10 to 12 inches. Permeability is moderate, runoff is very slow, and the hazard of erosion is slight to none. The rooting depth is very deep.

This soil is mostly in dryland pasture, but some small areas are used for grain. Capability unit IVc–1 (15); pasture and range site 7.

Docas silt loam, 2 to 9 percent slopes (DoC).—This soil is similar to Docas silt loam, 0 to 2 percent slopes, but is gently to moderately sloping. It occurs on flood plains and fans in upland valleys. Dominant slopes range from 3 to 6 percent. A few areas are gullied by water that runs in from the surrounding uplands. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

A few areas of this soil are used for dryland grain, but pasture is the dominant use. Capability unit IVc–1 (15); pasture and range site 7.

Docas clay loam, 0 to 2 percent slopes (DsA).—This soil is similar to Docas silt loam, 0 to 2 percent slopes, but has a gray to dark-gray clay loam surface soil. It occurs along drainageways in upland valleys. In some places the drainageways are deeply cut and have nearly vertical walls. Included in mapping were small areas of soils that have a silty clay loam surface soil.

This Docas soil is used mostly for pasture, but a few areas are in dryland grain. Capability unit IVc–1 (15); pasture and range site 7.

Docas clay loam, 2 to 9 percent slopes (DsC).—This soil is similar to Docas silt loam, 0 to 2 percent slopes, but it is gently sloping to moderately sloping and has a gray to dark-gray clay loam surface layer. It occurs on fans and flood plains in upland valleys. Dominant slopes are between 3 and 6 percent. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mostly for pasture, but a few small areas are used for dryland grain. Capability unit IVc–1 (15); pasture and range site 7.

Edenvale Series

The Edenvale series consists of somewhat poorly drained, very deep, clayey soils that formed in basic igneous alluvium. These soils are nearly level and occur on flood plains. The vegetation is annual grasses, forbs, and scattered oaks. Elevations range from 1,500 to 2,000 feet. Annual rainfall is 14 to 18 inches, average annual temperature is 60° F., and the frost-free period is about 260 days. The main associated soils are the Conejo and Cibo.

The surface layer is very dark gray clay 24 to 30 inches thick. The next layer is very dark gray clay alluvium that generally extends to depths below 5 feet.

The Edenvale soils are used for dryland and irrigated grain and pasture.

Edenvale clay, 0 to 2 percent slopes (EcA).—This soil lies on the flood plains and edges of flood plains.

Representative profile: 30 yards east of Quien Sabe Ranch.

Ap—0 to 10 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; strong, fine, granular structure; hard when dry, firm when moist, very sticky and very plastic when wet; plentiful very fine and fine roots; common, fine and medium, interstitial pores; neutral; abrupt, smooth boundary.

A1—10 to 26 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; strong, medium, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; plentiful very fine and fine roots; common, fine and medium, tubular pores, few, fine and medium, interstitial pores; common fine and medium slickensides; mildly alkaline; gradual, smooth boundary.

C1—26 to 42 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; moderate, fine, angular blocky structure; hard when dry, firm when moist, very sticky and very plastic when wet; few very fine and fine roots; common, very fine and fine, tubular pores; common fine and medium slickensides; common, small, soft masses of lime; moderately alkaline, strongly effervescent; gradual, smooth boundary.

C2—42 to 60 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; weak, medium, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few very fine and fine roots; few, very fine and fine, tubular pores; common, small, soft masses of lime; moderately alkaline, strongly effervescent.

Included with this soil are some stony soils and some soils that are affected by salts and alkali. Also included are some small areas of Conejo soils.

This soil has low to moderate fertility. Available water holding capacity is 8 to 10 inches. Runoff is very slow, permeability is slow, and the hazard of erosion is slight to none. The root zone is deep.

The soil is used for dryland and irrigated grain and pasture (fig. 7). Capability unit IIIw–5 (15).

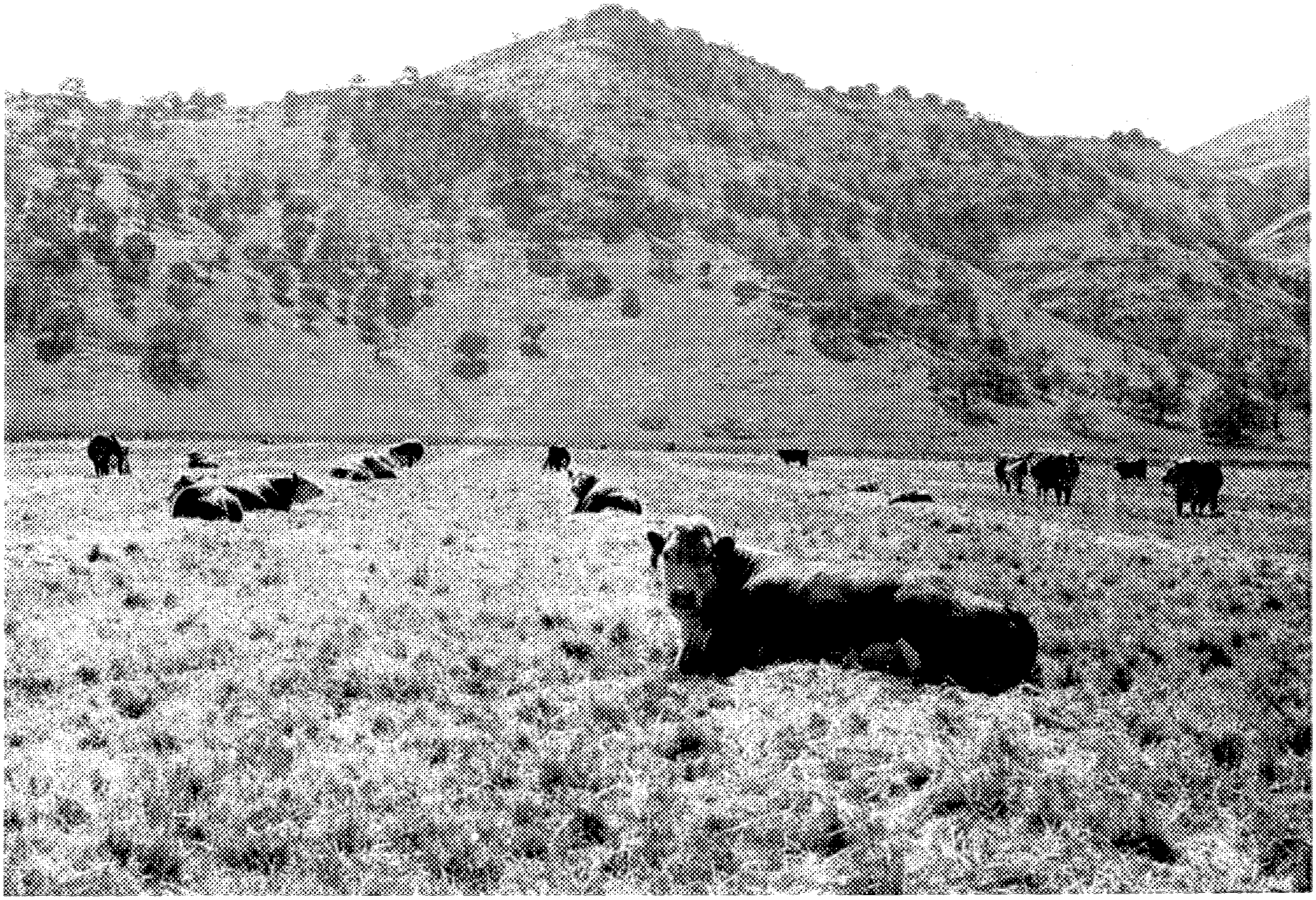

Figure 7.—Cattle grazing irrigated pasture on Edenvale clay, 0 to 2 percent slopes, in Quien Sabe Valley. Hills in background are Cibo stony clay, 15 to 50 percent slopes, eroded.

Gaviota Series

The Gaviota series consists of well-drained to somewhat excessively drained loamy and rocky loam soils underlain by sandstone and sandy shale. These soils are moderately steep to steep and occupy hilly mountainous uplands. The vegetation consists of annual grasses and forbs or a mixture of grasses, oaks, Digger pine, and brush. Elevations range from 1,200 to 3,800 feet above sea level. Annual rainfall is 14 to 20 inches. Average annual temperature is about 60° F., and the frost-free period is about 260 days. The main associated soils are the San Benito, Gazos, and Vallecitos.

In most places the surface layer is pale-brown loam 4 to 12 inches thick, but the color ranges to grayish brown. The next layer is pale-brown gravelly loam 4 to 12 inches thick. The underlying bedrock is chiefly moderately hard sandstone interbedded with shale. The depth to sandstone ranges from 8 to 24 inches, but is 12 to 20 inches in most places.

Gaviota soils are used for pasture, range, watersheds, wildlife, and recreation.

Gaviota loam, 30 to 50 percent slopes, eroded (GaF2).—This soil occupies steep slopes, some of which are the side slopes of narrow, winding ridges. In most areas erosion is moderate.

Representative profile: 300 yards north of Clear Creek Road, three-quarters mile from Hernandez Valley; on hillside.

A1—0 to 7 inches, pale-brown (10YR 6/3) loam, dark grayish brown (10YR 4/2) when moist; moderate, fine, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; few, very fine, tubular pores and common, very fine and fine, interstitial pores; slightly acid; gradual, wavy boundary.

C1—7 to 19 inches, pale-brown (10YR 6/3) gravelly loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; common, very fine and fine, tubular pores, common, very fine, interstitial pores; slightly acid; gradual, wavy boundary.

R—19 inches, yellowish-brown, highly fractured, medium-grained, moderately hard sandstone.

Included with this soil are small areas of San Benito, Gazos, and Vallecitos soils. Also included are small areas of calcareous soils, some severely eroded soils, and some areas of rock outcrops. In some areas bedrock is more than 20 inches below the surface.

This somewhat excessively drained soil has low fertility. Available water holding capacity is about 1 to 3 inches. Permeability is moderate, runoff is rapid to very rapid, and the hazard of erosion is severe to very severe. The root zone is shallow.

This soil is used for range, wildlife, watersheds, and recreation. Capability unit VIIe–1 (15); pasture and range site 6.

Gaviota loam, 15 to 30 percent slopes (GaE).—This soil is similar to Gaviota loam, 30 to 50 percent slopes, eroded, but it is less steep and is only slightly eroded. The depth to sandstone is as much as 24 inches. The color of the surface layer ranges from pale brown to grayish brown and is generally grayish brown on north-facing slopes. This soil occurs on rounded hills, and slopes are dominantly 20 to 25 percent. The plant cover is generally grass, scattered thin stands of oak, and a few Digger pine.

This soil is well drained. Available water holding capacity is 3 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to severe.

The soil is used for pasture. Capability unit VIe–1 (15); pasture and range site 6.

Gaviota loam, 15 to 30 percent slopes, eroded (GaE2).—This soil is similar to Gaviota loam, 30 to 50 percent slopes, eroded, but it is less steep. In some places it occurs as rounded ridgetops in areas of steep soils. Slopes are dominantly about 25 percent. This soil is underlain mainly by sandstone at a depth of 16 to 20 inches. The plant cover is chiefly grass and scattered oaks, but a few areas have a thin to thick cover of brush. Included with this soil are some areas of rock outcrops and of very shallow soils. These included areas generally make up less than 2 percent of the mapped areas.

This soil is well drained. Runoff is rapid, and the hazard of erosion is severe.

Pasture is the main use. Capability unit VIe–1 (15); pasture and range site 6.

Gaviota rocky loam, 15 to 50 percent slopes, eroded (GrF2).—Loam makes up most of this mapping unit, but rock outcrops cover about 2 to 10 percent of the surface, and there are small included areas of other soils. The underlying bedrock is commonly sandstone but includes a moderate amount of interbedded shale in some places. The depth to bedrock ranges from 8 to 16 inches, which is shallower than normal for the series. Slopes are dominantly 45 to 50 percent, and relief ranges from somewhat angular hills to mountains. The vegetation consists of grasses, brush, and scattered trees. In the east-central part of the county, the plant cover is mostly grass and some brush and scattered oaks. In the southern part, it is mostly brush and wildfires are common. Most areas of this soil are moderately eroded, but some areas are severely eroded, especially in the southern part of the county.

Included with this mapping unit are small to medium-sized areas of Sedimentary rock land, small to medium-sized areas that are severely eroded, and small areas of Gazos and Vallecitos soils.

This well drained to somewhat excessively drained soil is generally low in fertility. Available water holding capacity is 2 to 3 inches. Runoff is rapid to very rapid, and the hazard of erosion is severe to very severe.

This soil is used for range, wildlife, watersheds, and recreation. Capability unit VIIs–1 (15); pasture and range site 6.

Gazos Series

The Gazos series consists of well-drained to somewhat excessively drained loamy soils. These soils are underlain by soft to moderately hard, acid, interbedded shale and sandstone at a depth of 20 to 60 inches. They are strongly sloping to very steep and occupy hilly to mountainous uplands. Vegetation consists chiefly of annual grasses and forbs, but there are thin to moderately thick stands of oaks and Digger pine and large areas of brush on the more eroded slopes. Elevations range from 1,200 to 3,800 feet above sea level. Annual rainfall is 14 to 20 inches, average annual temperature is about 60° F., and the frost-free period is about 260 days. The main associated soils are the Gaviota, Santa Lucia, San Benito, Henneke, and Linne.

The surface layer is grayish-brown or dark grayish-brown clay loam to silty clay loam 10 to 20 inches thick. The next layer is brown clay loam to shaly clay loam 10 to 40 inches thick. The underlying bedrock is largely soft clay shale and sandy clay shale with thin to moderately thick beds of soft, medium-grained sandstone. The depth to sandstone or shale ranges from 20 to 60 inches. These soils range from medium acid to slightly acid but are dominantly medium acid.

Gazos soils are used for dryland grain, pasture, and range and for watersheds, wildlife, and recreation.

Gazos clay loam, 15 to 30 percent slopes, eroded (GtE2).—This soil occurs on rounded ridges and in areas of steeper soils. In most places it is moderately eroded, but it is severely eroded in small areas.

Representative profile: On Tully Ranch, 10 yards above ranch road; 2 miles east of State Route 25.

A11—0 to 8 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, granular structure; hard when dry, firm when moist, sticky and plastic when wet; abundant very fine and fine roots; common, very fine and fine, interstitial pores; slightly acid; gradual, smooth boundary.

A12—8 to 17 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few very fine and fine roots; common, very fine, tubular pores; slightly acid; gradual, smooth boundary.

AC—17 to 34 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few very fine and fine roots; few, very fine, tubular pores; few, fine slickensides; common stains of material from the A horizon on ped surfaces; medium acid; gradual, smooth boundary.

C—34 to 46 inches, brown (10YR 5/3) shaly clay loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few, very fine, tubular pores; some relic structure; medium acid; gradual, smooth boundary.

R—46 inches, olive-gray (5Y 5/2), highly weathered, highly fractured, moderately hard, acid shale that contains thin beds of yellowish-brown (10YR 5/4), medium-grained sandstone.

Included with this soil are some small areas of Santa Lucia, San Benito, Linne, and Henneke soils. Also included are some areas of clayey soils and small areas of rock outcrop.

This soil is moderately fertile. Available water holding capacity is about 4 to 8 inches. Permeability is moderately slow, runoff is rapid, and the hazard of erosion is severe. The root zone extends to a depth of 24 to 48 inches.

This soil is used for pasture. Capability unit IVe–5 (15); pasture and range site 5.

Gazos silty clay loam, 9 to 15 percent slopes (GsD).—This soil is similar to Gazos clay loam, 15 to 30 percent slopes, eroded, but it has a thicker profile, is less sloping, and is only slightly eroded. It occurs on toe slopes. Reaction throughout the profile is dominantly slightly acid. Included with this soil are some clayey soils.

Runoff is medium, and the hazard of erosion is moderate. Available water holding capacity is about 8 to 10 inches. The root zone is deep.

This soil is used for dryland grain and pasture. Capability unit IIIe–5 (15); pasture and range site 5.

Gazos clay loam, 30 to 50 percent slopes, eroded (GtF2).—This soil is similar to Gazos clay loam, 15 to 30 percent slopes, eroded, but it is steeper and has a slightly thinner profile. It is in areas where ridgetops are narrow and winding. Slopes are dominantly 45 to 50 percent. Depth to underlying bedrock ranges from 20 to 50 inches but is 20 to 36 inches in most places. The plant cover ranges from grass and scattered oaks and Digger pine to moderately thick stands of oaks and pines and areas of brush.

Included with this soil are small to medium-sized outcrops of shale and sandstone and small areas of very thin soils. Also included are small areas of ultrabasic intrusions and rock outcrops and small areas of San Benito and Gaviota soils.

This soil is somewhat excessively drained. Available water holding capacity is 4 to 6 inches. The root zone is moderately deep. Runoff is rapid to very rapid, and the hazard of erosion is severe to very severe.

The soil is used for pasture, watersheds, recreation, and wildlife. Capability unit VIe–5 (15); pasture and range site 5.

Gazos clay loam, 50 to 75 percent slopes, severely eroded (GtG3).—This soil is similar to Gazos clay loam, 15 to 30 percent slopes, eroded, but it is much steeper, has a thinner profile, and is severely eroded. Slopes are dominantly 55 to 60 percent. The underlying bedrock, at an average depth of about 24 inches, is mostly shale and thin layers of sandstone. This soil is covered with brush, is thinly covered with grasses, or is almost bare. Drainage is somewhat excessive. Runoff is very rapid, and the hazard of erosion is very severe. Available water holding capacity is about 2 to 4 inches.

This soil is used for range and for watersheds, wildlife, and recreation. Capability unit VIIe–5 (15); pasture and range site 5.

Gullied Land

Gullied land (GuE) consists of alluvial areas that have been very severely damaged by erosion and gullying (fig. 8). These areas occur around water seeps, in areas of salt and alkali, and where water flowing from the hills concentrates and crosses alluvial areas on its way to a larger stream. Most areas are eroded by water, but in the Bolsa Area damage has been by both water and wind. In most places Gullied land is barren, though there are small areas of thin grass. Siltation is high.

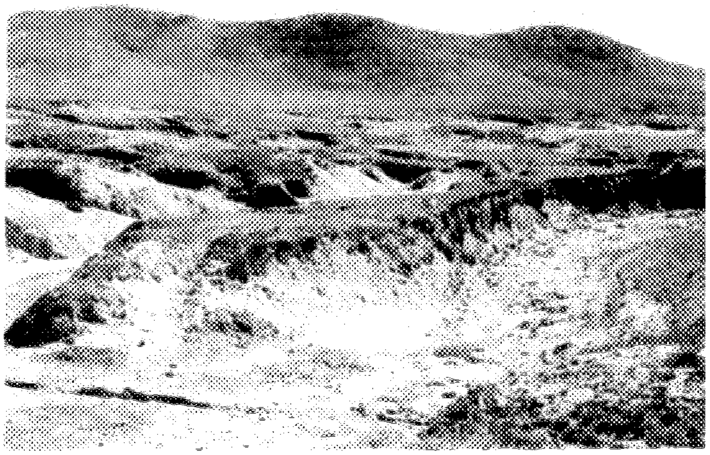

Figure 8.—**Area of Gullied land in Vallecitos Valley, southeastern San Benito County. Most of the damage is caused by runoff from the nearby hills.**

This land is useful for watershed purposes and for range where grazing is restricted. Capability unit VIIe–1 (15); pasture and range site 6.

Hanford Series

The Hanford series consists of well-drained loamy soils that formed in alluvium derived from acid igneous rock. These soils are nearly level to sloping; they occur on flood plains and fans. The vegetation consists of annual grasses and forbs and scattered oaks and Digger pine. A few small areas are in brush. Elevations range from 200 to 2,000 feet above sea level. Annual rainfall is 12 to 16 inches. Average annual temperature is about 60° F., and the frost-free period is about 260 days. The main associated soils are the Sheridan, Auberry, and Salinas.

The surface layer is grayish-brown and dark grayish-brown loam or coarse sandy loam about 20 inches thick. The next layer is grayish-brown loam about 4 inches thick. It is underlain by stratified coarse loamy sand and sandy loam that ranges from 22 to 40 inches. Below this is pale-brown coarse loamy sand.

The Hanford soils are used for irrigated walnuts, pears, sugar beets, tomatoes, and vegetables; for irrigated and dryland wine grapes; and for dryland grain and incidental pasture.

Hanford coarse sandy loam, 0 to 2 percent slopes (HaA).—This soil is nearly level and lies on flood plains along drainageways and in the larger valleys.

Representative profile: North of private road to St. Francis Retreat, 1 mile southeast of San Juan Bautista, 200 yards northeast of race track.

Ap—0 to 8 inches, grayish-brown (10YR 5/2) coarse sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; hard when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful very fine and fine roots; few, very fine and fine, interstitial pores; slightly acid; clear, smooth boundary.

A1—8 to 20 inches, dark grayish-brown (10YR 4/2) coarse sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, subangular blocky structure; hard when dry, very friable when moist, nonsticky and nonplastic when wet; few very fine and fine roots; few, very fine and fine, interstitial pores; slightly acid; abrupt, smooth boundary.

AC—20 to 26 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; common, very fine and fine, interstitial pores; 1-inch layer of coarse sand at top of horizon; slightly acid; clear, smooth boundary.

IIC1—26 to 48 inches, grayish-brown (10YR 5/2), stratified, loamy coarse sand and sandy loam, very dark grayish brown (10YR 3/2) when moist; single grain; loose when dry, loose when moist, nonsticky and nonplastic when wet; few very fine and fine roots; slightly acid; clear, smooth boundary.

IIC2—48 to 70 inches, pale-brown (10YR 6/3) loamy coarse sand, dark brown (10YR 3/3) when moist; weak, fine, subangular blocky structure; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; slightly acid; clear, smooth boundary.

Included with this soil are some small areas of Salinas soils and some soils that are sandy throughout the profile.

This soil has low to moderate fertility. Available water holding capacity is about 6 to 8 inches. Permeability is rapid, runoff is very slow, and the hazard of erosion is slight to none. The root zone is very deep.

This soil is used for irrigated fruits, nuts, row and field crops and for dryland grain and incidental pasture. Capability units IIs-4 (14) and IIIs-4 (15).

Hanford coarse sandy loam, 2 to 9 percent slopes (HaC).—This soil is similar to Hanford coarse sandy loam, 0 to 2 percent slopes, but it is more sloping and, in most places, is browner. It lies in narrow valleys, on fans, and along the sides of the larger valleys. Slopes are dominantly 3 to 5 percent, but they average 8 percent on small fans and in very narrow valleys. The vegetation is grass, scattered oaks and Digger pine, and brush in some areas. Underlying this soil is stratified material that generally contains lenses of finer textured material and one or more horizons of a buried soil.

Runoff is slow to medium. The hazard of erosion is slight to moderate.

This soil is used for irrigated walnuts and for irrigated and dryland grapes, grain, and incidental pasture. Capability units IIIe-4 (14) and IIIe-1 (15).

Hanford loam, 0 to 2 percent slopes (HfA).—This soil is similar to Hanford coarse sandy loam, 0 to 2 percent slopes, but it has a loam surface layer and, in some places, slightly more water-holding capacity. Available water holding capacity is about 7.5 to 8.5 inches. This soil occurs in narrow areas along drainageways or in small areas in the larger valleys. It is generally grayish brown but ranges toward gray in some places. The underlying material is stratified with lenses of loamy coarse sand to loam.

Included with this soil are small areas of soils that have impeded drainage.

This soil is used for irrigated sugar beets, tomatoes, and vegetables; for irrigated and dryland grapes; and for dryland grain and incidental pasture. Capability units I-1 (14) and IIIc-1 (15).

Hanford loam, 2 to 9 percent slopes (HfC).—This soil is similar to Hanford coarse sandy loam, 0 to 2 percent slopes, but it has a loam surface layer, contains lenses of medium-textured material in the substratum, and is gently sloping to moderately sloping. Areas of this soil are small or medium in size, and they occur in the larger valleys where slopes that extend from the hills tend to become less steep. This soil is generally grayish brown, but it ranges to gray in some places. The underlying material is stratified and generally contains one or more buried horizons. It also contains gravel in some areas.

Included with this soil are a few small areas of soils that have impeded drainage.

Available water holding capacity is 7.5 to 8.5 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for irrigated and dryland grapes and for dryland grain and incidental pasture. Capability units IIe-1 (14) and IIIe-1 (15).

Henneke Series

The Henneke series consists of well-drained to somewhat excessively drained, very gravelly, loamy soils that are underlain by ultrabasic igneous rocks at a depth of 17 to 25 inches. These soils occur in mountainous uplands and are moderately steep to very steep. Most areas are bare or are covered with brush and with a scattered to thin stand of pine. Elevations range from 2,500 to 4,000 feet above sea level. Annual rainfall is 14 to 20 inches. Average annual temperature is about 60° F., and the frost-free period is about 250 days. The main associated soils are the Climara, Gaviota, Montara, and Gazos.

The surface layer is brown fine gravelly loam 3 to 6 inches thick. The subsoil is reddish-brown very gravelly clay loam 6 to 12 inches thick. Generally, a layer of light yellowish-brown gravelly clay loam, 8 to 14 inches thick, occurs between the subsoil and the underlying serpentine bedrock. The amount and size of gravel in the profile vary from place to place.

The Henneke soils are used for range and for watersheds, wildlife, and recreation.

Henneke fine gravelly loam, 15 to 50 percent slopes, eroded (HnF2).—This moderately steep to steep soil is sparsely covered with brush. In most places erosion is moderate, but it is severe in some areas.

Representative profile: On northwest side of road, one-half mile north of Clear Creek, on New Idria Grade; Clear Creek-New Idria Road.

A—0 to 3 inches, brown (7.5YR 5/2) fine gravelly loam, dark brown (7.5YR 3/2) when moist; moderate, fine, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; many, very fine and fine, interstitial pores; slightly acid; clear, wavy boundary.

B2t—3 to 11 inches, reddish-brown (5YR 5/4) very gravelly clay loam, dark reddish brown (5YR 3/4) when moist; moderate, fine, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; abundant very fine and medium roots; many, very fine and fine, interstitial pores; thin patchy clay films on surfaces of peds and sand grains; neutral; gradual, smooth boundary.

C—11 to 25 inches, light yellowish-brown (10YR 6/4) very gravelly clay loam, dark yellowish brown (10YR 4/4) when moist; weak, medium, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; plentiful fine and medium roots; common, very fine, tubular pores, common, very fine and fine, interstitial pores; neutral; gradual, smooth boundary.

R—25 inches, light greenish-gray (5G 7/1), highly weathered, highly fractured, serpentine rock, greenish gray (5G 5/1) when moist.

This soil is covered with a thin layer of fine greenish-gray fragments of serpentine. A thin layer of partly decomposed leaves and twigs occurs in brushy areas.

Included with this soil are some small areas of Climara and Montara soils and of Igneous rock land. Also included are some stony areas and rock outcrops.

This soil has very low fertility. It has a low calcium-magnesium ratio and is deficient in calcium. Available water holding capacity is 2 to 3 inches. Permeability is moderately slow, runoff is rapid to very rapid, and the hazard of erosion is severe to very severe. The root zone extends to a depth of 17 to 25 inches in most places, but it is as deep as 28 inches in some small areas.

This soil is used for range, wildlife, and watersheds. Capability unit VIIe-1 (15); pasture and range site 8.

Henneke soils, 15 to 75 percent slopes, severely eroded (HsG3).—These soils are bare or are covered with brush and scattered Digger and Coulter pines. They are generally brown to reddish brown, but in many places a greenish-gray cast is imparted by the fine serpentine fragments on the surface. Texture ranges from fine gravelly loam to gravelly clay, but it is dominantly fine gravelly loam to fine gravelly clay loam. Included with these soils are rock outcrops that make up as much as 35 percent of some areas.

These soils have very low fertility. Available water holding capacity is 2 to 4 inches. Runoff is rapid to very rapid, and the hazard of erosion is very severe.

These soils are used for wildlife and watersheds. Capability unit VIIIs-1 (15).

Igneous Rock Land

Igneous rock land (IgG) consists dominantly of areas of igneous rock outcrops and of very shallow soils. The outcrops commonly cover 35 to 90 percent of the surface. The plant cover varies. In the southern part of the county, many areas are bare where the rock consists of serpentine and of silica-carbonates. Other areas have a moderately thick cover of brush and scattered Digger and Coulter pines. Areas underlain by granite in the Gabilan Range generally have a thick cover of brush and scattered Digger and Coulter pines. North of Quien Sabe Valley, areas on basic igneous rock generally have a thin cover of grass, brush, and a few scattered oaks. In some places, this land can be used for limited grazing.

This land is excessively drained. It receives low to moderate amounts of silt from other areas. It is used for watersheds and has limited use for wildlife and recreation. Capability unit VIIIs-1 (15).

Kettleman Series

The Kettleman series consists of well-drained loamy soils that are underlain by calcareous sandstone and shale at a depth of 20 to 60 inches. These soils are strongly sloping to steep and occur in hilly to mountainous uplands. The vegetation is annual grasses and forbs and sparse low brush in some of the steeper, more eroded areas. Elevations range from 1,300 to 2,500 feet above sea level. Annual rainfall is 5 to 10 inches, average annual temperature is about 62° F., and the frost-free period is about 270 days. The main associated soils are the Linne, Nacimiento, and Shedd.

The surface layer is pale-brown loam 10 to 22 inches thick. The next layer is light yellowish-brown loam 15 to 30 inches thick. It overlies soft calcareous sandstone and shale.

The color of these soils ranges from pale brown or brown to light yellowish brown or light brownish gray. The texture ranges from sandy loam to loam, depending on whether the underlying material is sandstone or shale. Texture varies considerably within a short distance because the sandstone and shale are interbedded in many places. Depth to the underlying material ranges from 20 to 60 inches.

Kettleman soils are used for range, watersheds, wildlife, and recreation.

Kettleman loam, 15 to 50 percent slopes, eroded (KeF2).—This soil is moderately steep to steep and lies on rolling hills and side slopes in the uplands. In most areas it is moderately eroded, but a few small areas are severely eroded.

Representative profile: On Ashurst Ranch, by ranch road, 2 miles north of junction of Ashurst oil lease road and New Idria Road.

A11—0 to 10 inches, pale-brown (10YR 6/3) loam, brown (10YR 4/3) when moist; moderate, fine, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; few, very fine and fine, tubular pores, common, very fine and fine, interstitial pores; moderately alkaline, slightly effervescent; gradual, smooth boundary.

A12—10 to 22 inches, pale-brown (10YR 6/3) loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; many, very fine, fine, and medium, tubular pores; moderately alkaline, strongly effervescent; gradual, smooth boundary.

C1—22 to 41 inches, light yellowish-brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; common, very fine and fine, tubular pores; few fine flecks of lime; moderately alkaline, strongly effervescent; gradual, wavy boundary.

C2—41 to 51 inches, light yellowish-brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few, very fine and fine, tubular pores; few fine flecks of lime; moderately alkaline, violently effervescent; gradual, irregular boundary

C3—51 inches, yellowish-brown (10YR 5/4), highly weathered sandstone that is highly fractured, soft, and calcareous.

Included with this soil are soils that are less than 20 inches deep over bedrock and some small areas of Nacimiento soils.

This soil is moderately fertile. Available water holding capacity is 6 to 8 inches. Permeability is moderate, runoff is rapid to very rapid, and the hazard of erosion is severe to very severe. The root zone extends to a depth of 36 to 48 inches.

This soil is used for range, wildlife, recreation, and watersheds. Capability unit VIIe-1 (15); pasture and range site 9.

Kettleman loam, 5 to 15 percent slopes (KeD).—This soil is similar to Kettleman loam, 15 to 50 percent slopes, eroded, but it is deeper over sandstone or shale bedrock, is less sloping, and is only slightly eroded. It occurs on low, rounded hills in rolling areas, in areas of less sloping soils at the heads of drains, or in upland valleys. In color, this soil ranges from pale brown to light brownish gray.

Included with this soil are some small areas of gravelly soils and soils that have a clay loam surface layer.

Available water holding capacity is about 6 to 10 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The root zone extends to a depth of 36 to 60 inches.

This soil is used for range. Capability unit VIe-1 (15); pasture and range site 9.

Kettleman soils, 15 to 50 percent slopes, eroded (KmF2).—Of this mapping unit, about 70 percent is Kettleman loam, 15 to 50 percent slopes, eroded; 20 percent is an eroded rocky Kettleman loam; and the rest is inclusions. The inclusions are gravelly soils, severely eroded soils less than 20 inches to bedrock, and small areas of Nacimiento soils.

This mapping unit is generally 20 to 30 inches deep over bedrock. It occurs in hilly to mountainous areas. Fertility is low and available water holding capacity is about 3 to 5 inches. Runoff is rapid to very rapid, and the hazard of erosion is severe to very severe.

This mapping unit is used for range, wildlife, watersheds, and recreation. Capability unit VIIe-1 (15); pasture and range site 9.

Landslides

Landslides (LdF) consists of soil that has moved downslope and of the scarred surfaces resulting from this movement (fig. 9). Areas range from a few acres to several hundred acres in size. This land has an uneven or broken surface, and the soil mantle has been so disturbed that soil characteristics are unpredictable. Runoff has increased in some places, and gullies and severe erosion are common, especially around the edges of the slides. Silt production is generally moderate to high, and further slippage is a danger. The material is generally fine textured and ranges from clay loam to clay.

This land has low to moderate fertility. Available water holding capacity ranges from 1 to 6 inches. Runoff is rapid to very rapid, and the hazard of erosion is severe to very severe.

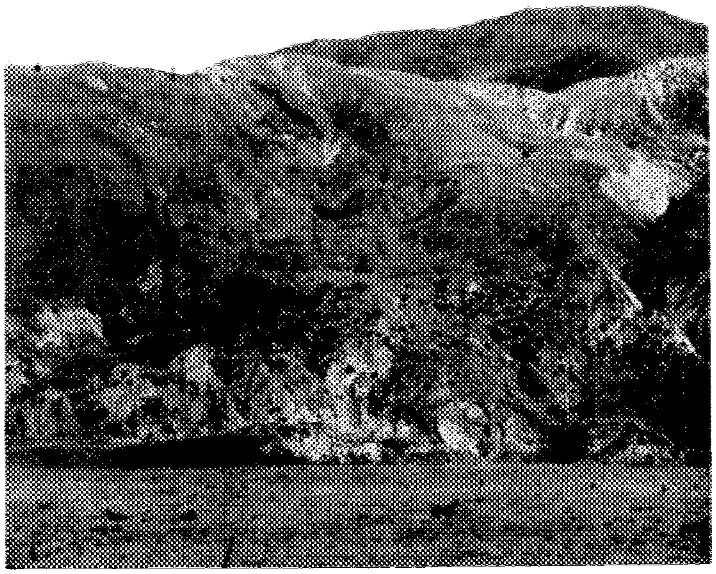

Figure 9.—**An area of Landslides and steep broken land. This area is along the San Benito River, south of Hollister.**

Landslides are used for range and watersheds. Capability unit VIIe-5 (15); pasture and range site 1.

Laniger Series

The Laniger series consists of somewhat excessively drained gravelly loamy soils that are underlain by semiconsolidated rhyolitic conglomerate at a depth of 20 to 48 inches. These soils are steep to very steep and lie on uplands. The vegetation consists mostly of brush, but there are some scattered Digger pine and small areas of annual grasses and forbs. Elevations are from 1,500 to 2,500 feet above sea level. Annual rainfall is about 20 inches. The average annual temperature is about 60° F., and the frost-free period is about 260 days. The main associated soils are the Santa Lucia and Pinnacles.

The surface layer is grayish-brown gravelly sandy loam, 8 to 22 inches thick. The subsoil consists of 12 to 26 inches of very pale brown gravelly coarse sandy loam. Depth to bedrock is 20 to 48 inches. The amount of gravel in the profile varies from place to place.

Laniger soils are used for range, watersheds, wildlife, and recreation.

Laniger gravelly sandy loam, 30 to 75 percent slopes, severely eroded (LaG3).—This soil is steep to very steep and occupies hills with narrow, winding ridgetops. Slopes are dominantly 45 to 60 percent.

Representative profile: On hillside to the narrowest of the junction of State Route 25 and the Pinnacles Road.

A—0 to 11 inches, grayish-brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful very fine and fine roots; common, very fine and fine, interstitial pores; neutral; gradual, smooth boundary.

B2—11 to 29 inches, very pale-brown (10YR 7/3) gravelly coarse sandy loam, brown (10YR 5/3) when moist; weak, fine, subangular blocky structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; few very fine and fine roots; few, fine, interstitial pores; medium acid; gradual, smooth boundary.

R—29 inches +, yellowish-brown (10YR 5/6), coarse-grained, extremely gravelly, semiconsolidated, medium acid conglomerates of the Temblor formation.

Included with this soil are small areas of Santa Lucia and Pinnacles soils and of some soils that have a loamy sand surface layer. Also included are some areas of Landslides and of soils that are less than 20 inches deep over bedrock.

This soil has low fertility. Available water holding capacity is about 1.5 to 4 inches. Permeability is rapid, runoff is rapid to very rapid, and the hazard of erosion is severe to very severe. The root zone is moderately deep to deep.

The soil is used for range, wildlife, watersheds, and recreation. Capability unit VIIe-4 (15); pasture and range site 3.

Linne Series

The Linne series consists of well-drained loamy soils that are underlain by interbedded, soft, calcareous sandstone and shale. These soils are strongly sloping to steep and lie on uplands. The vegetation consists of annual grasses and forbs and scattered oaks in some areas. A few of the more eroded areas have a cover of low brush. Elevations range from 700 to 2,200 feet above sea level. Annual rainfall is 10 to 14 inches. The average annual temperature is about 60° F., and the frost-free period is about 260 days. The main associated soils are the Gaviota, San Benito, Diablo, Kettleman, Shedd, and Nacimiento.

The surface layer is gray clay loam 12 to 24 inches thick. The next layer is light brownish-gray clay loam 12 to 24 inches thick. Olive-gray, soft, calcareous sandstone and shale is at a depth of 24 to 48 inches.

Linne soils are used for dryland grain, pasture, and range.

Linne clay loam, 15 to 30 percent slopes, eroded (LnE2).—This soil is moderately steep and occupies hills or rounded ridges in areas of steeper soil. In most places it is moderately eroded, but a few small areas are severely eroded.

Representative profile: On hillside above ranch road, 2½ miles north of State Route 25 in Bitterwater Valley.

A11—0 to 12 inches, gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) when moist; weak, fine, granular structure; slightly hard when dry, very friable when moist, sticky and plastic when wet; plentiful very fine and fine roots; common, very fine and fine interstitial pores; few fine seams of lime; few fine coatings of lime on ped surfaces; moderately alkaline, violently effervescent; clear, smooth boundary.

A12—12 to 24 inches, gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, very friable when moist, sticky and plastic when wet; plentiful very fine and fine roots; common, very fine and few, medium, tubular pores; many fine and medium seams of lime, many, medium, lime coatings on ped surfaces, few, small, soft masses of lime; few small fragments of weathered sandstone; moderately alkaline, violently effervescent; gradual, smooth boundary.

Cca—24 to 38 inches, light brownish-gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; few, very fine and fine, tubular pores, few, very fine and fine, interstitial pores; many fine seams of lime, many, soft, small and medium masses of lime; few small fragments of weathered sandstone; moderately alkaline, violently effervescent; gradual, irregular boundary.

R—38 inches, soft, calcareous, olive-gray shale (5Y 5/2), with few thin beds of soft, medium-grained, calcareous sandstone.

Included with this soil are some small areas of San Benito, Shedd, Kettleman, and Diablo soils.

This soil is moderately fertile. Available water holding capacity is about 5 to 10 inches. Permeability is moderately slow, runoff is rapid, and the hazard of erosion is severe. The root zone is moderately deep to deep.

This soil is used for dryland grain and pasture. Capability unit IVe-5 (15); pasture and range site 1.

Linne clay loam, 9 to 15 percent slopes (LnD).—This soil is similar to Linne clay loam, 15 to 30 percent slopes, eroded, but it is less sloping and is only slightly eroded. It occurs on broad ridges in areas of steeper soils. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil are small areas of Diablo soils in saddles and around drainageways.

This soil is used for dryland grain and pasture. Capability unit IIIe-5 (15); pasture and range site 1.

Linne clay loam, 30 to 50 percent slopes, eroded (LnF2).—This soil is similar to Linne clay loam, 15 to 30 percent slopes, eroded, but it is steeper and has a slightly thinner profile. It is steep and generally occupies hills that have narrow, rounded, winding ridges. Slopes are dominantly 40 to 50 percent.

Included with this soil are small areas of San Benito, Shedd, and Pinnacles soils. Also included are some small Landslides and a few small severely eroded areas.

Available water holding capacity is about 5 to 7 inches. Runoff is rapid to very rapid, and the hazard of erosion is severe to very severe.

The soil is used for dryland pasture. Capability unit VIe-5 (15); pasture and range site 1.

Linne clay loam, 30 to 50 percent slopes, severely eroded (LnF3).—This soil is similar to Linne clay loam, 15 to 30 percent slopes, eroded, but it is steeper, is more eroded, and has a thinner profile. Slopes are dominantly 45 to 50 percent.

Included are some areas of Shedd and Gaviota soils, of shallow soils, and of rock outcrop and Landslides.

This soil has low fertility. Available water holding capacity is about 3 to 5 inches. Runoff is rapid to very rapid, and the hazard of erosion is very severe. The root zone is moderately deep.

This soil is used for range, wildlife, watersheds, and recreation. Capability unit VIIe-5 (15); pasture and range site 1.

Linne-Shedd complex, 15 to 30 percent slopes, eroded (LsE2).—This complex consists of about 60 percent Linne clay loam, 15 to 30 percent slopes, eroded, and 40 percent Shedd loam, 15 to 30 percent slopes, eroded. These soils are severely eroded in some places. These moderately steep soils generally occur on rounded hills. The Linne soil occupies the gentler slopes, areas in saddles and along drainageways, and larger areas on north-facing slopes.

The soils of this complex are covered by grass and some scattered oaks on north-facing slopes. A few areas of Shedd soils have a cover of low brush.

Included with this mapping unit are a few small areas of Diablo soils along drainageways and a few small severely eroded areas.

These soils have moderate fertility. Runoff is rapid, and the hazard of erosion is severe.

Pasture is the main use. Capability unit IVe–5 (15); pasture and range site 7.

Linne-Shedd complex, 30 to 50 percent slopes, eroded (LsF2).—This complex consists of about equal amounts of Linne clay loam, 30 to 50 percent slopes, eroded, and Shedd loam, 30 to 50 percent slopes, eroded. These soils are steep and occur on slopes that have narrow, rounded, winding ridges. Slopes are dominantly about 45 percent but are as steep as 55 percent in a few areas. The Linne soil generally occupies saddles, less sloping drainage areas, and areas on the north-facing slopes. The Shedd soil ranges from 20 to 30 inches in depth to underlying material. It is generally moderately to severely eroded and has a sparse cover of grass and of low brush on the more eroded areas.

The Linne soil is somewhat less eroded and is generally deeper than the Shedd soil. The Linne soil is 24 to 40 inches deep. It has a dense cover of grass.

Included with this complex are a few small areas of Diablo soils and of rock outcrops.

Runoff is rapid to very rapid, and the hazard of erosion is severe to very severe.

These soils are used for pasture and watersheds. Capability unit VIe–5 (15); pasture and range site 7.

Lodo Series

The Lodo series consists of somewhat excessively drained shaly and loamy soils that are underlain by shale bedrock at a depth of 12 to 18 inches. These soils are very steep and lie on uplands. The vegetation consists of annual grasses and forbs and thin stands of oaks and Digger pine. Brush covers a few of the more eroded areas. Elevations range from 1,200 to 2,000 feet above sea level. Annual rainfall is 12 to 16 inches. The average annual temperature is about 60° F., and the frost-free period is about 250 days. The main associated soils are the Linne, Gazos, San Benito, and Shedd.

The surface layer is gray shaly loam about 12 to 18 inches thick over fractured bedrock. Grayish-brown loam is in the fractures. These soils range from slightly acid to mildly alkaline, and the shale is slightly calcareous in a few areas.

Lodo soils are used for range, watersheds, recreation, and wildlife.

Lodo shaly loam, 50 to 75 percent slopes, eroded (LtG2).—This soil is very steep and occurs on ridges that have narrow tops. It is dominantly moderately eroded but is severely eroded in some areas.

Representative profile: On ranch road, on hillside, 300 yards south of State Route 25; in lower Bitterwater Valley.

A11—0 to 4 inches, gray (10YR 5/1) shaly loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; common, very fine, tubular pores, common, fine, interstitial pores; slightly acid; clear, smooth boundary.

A12—4 to 14 inches, gray (10YR 5/1) shaly loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; many, very fine and fine, tubular pores, common, fine and medium, interstitial pores; slightly acid; gradual, smooth boundary.

R—14 inches, fractured, acid, moderately hard shale with grayish brown (10YR 5/2) loam in the cracks.

Included with this soil are some small areas of Gazos, Shedd, and Linne soils. Also included are some small Landslides, outcrops of shale, and severely eroded areas.

This soil has low fertility. Available water holding capacity is about 1 to 2 inches. Permeability is moderately rapid, runoff is very rapid, and the hazard of erosion is very severe.

The soil is used for range, watersheds, recreation, and wildlife. Capability unit VIIe–1 (15); pasture and range site 5.

Los Banos Series

The Los Banos series consists of well-drained clay loam soils that are underlain by gravelly semiconsolidated alluvium and lakebed clays. These soils are gently sloping to steep and occupy terraces and fans. The vegetation consists of annual grasses and forbs. Elevations range from 1,200 to 2,000 feet above sea level. Annual rainfall ranges from 5 to 8 inches. The average annual temperature is about 62° F., and the frost-free period is about 260 days. The main associated soils are the Kettleman, Panoche, and Panhill.

The surface layer is brown or reddish-brown clay loam 10 to 16 inches thick. The subsoil is reddish-brown clay that ranges from 10 to 32 inches in thickness. The underlying semiconsolidated terrace deposits occur at a depth of 20 to 48 inches. Lakebed clays underlie the terrace deposits at a depth of 4 to 30 feet. These soils are gravelly throughout the profile in some places.

Los Banos soils are used for range, watersheds, wildlife, and recreation.

Los Banos clay loam, 9 to 15 percent slopes, eroded (LuD2).—This soil occurs on high terraces or along drainageways. It is severely eroded in some areas.

Representative profile: 400 yards north of Little Panoche Road; by sheep camp.

A11—0 to 5 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) when moist; strong, fine, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; abundant very fine and fine roots; few, very fine and fine, tubular pores; mildly alkaline; gradual, smooth boundary.

A12—5 to 13 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) when moist; strong, medium, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; abundant very fine and fine roots; common, very fine and fine, tubular pores; mildly alkaline; gradual, smooth boundary.

B2t—13 to 23 inches, reddish-brown (5YR 5/4) clay, reddish brown (5YR 4/4) when moist; strong, fine, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet;

plentiful very fine and fine roots; few, very fine and fine, tubular pores; roots oriented along ped surfaces; thin patchy clay films on ped surfaces; few fine slickensides; few fine pebbles; moderately alkaline, strongly effervescent: gradual, smooth boundary.

IIC—23 inches, mixture of semiconsolidated calcareous sand, gravel, and clay; very dense and compact.

Included with this soil are soils that are less than 20 inches deep over the semiconsolidated substratum. Also included are some small areas of Panhill and Panoche soils and some soils that have a clay surface layer.

This soil has low to moderate fertility. Available water holding capacity is 4 to 6 inches. Permeability is slow, runoff is medium to rapid, and the hazard of erosion is moderate to severe. The root zone is moderately deep.

This soil is used for range. Capability unit VIIe-1 (15); pasture and range site 10.

Los Banos clay loam, 2 to 9 percent slopes (LuC).—This soil is similar to Los Banos clay loam, 9 to 15 percent slopes, eroded, but it is less sloping, is only slightly eroded, and has a slightly thicker profile. It is gently sloping to moderately sloping and occurs on long, broad, high terraces or on long, broad fans. Slopes are dominantly between 4 and 6 percent. This soil is slightly eroded, but some areas along old drainageways are moderately eroded. Depth to the semiconsolidated substratum ranges from 20 to 48 inches but averages 30 to 48 inches in most places. Threads of lime occur in many pores and cracks in the subsoil. A few areas have gravel throughout the profile.

Included with this soil are some small areas of Panhill and Panoche soils and of soils that are calcareous throughout.

Available water holding capacity is 5 to 8 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The root zone is moderately deep to deep.

This soil is used for range. Capability unit VIIe-1 (15); pasture and range site 10.

Los Banos clay loam, 15 to 50 percent slopes, severely eroded (LuF3).—This soil is similar to Los Banos clay loam, 9 to 15 percent slopes, eroded, but it has a thinner profile, is steeper, and is more eroded. It occurs on rounded hills or on side slopes in areas of gently sloping soils. Slopes are dominantly 35 to 45 percent. Drainage patterns are deeply incised.

Included with this soil are areas that have less clay in the subsoil, areas truncated by erosion, areas where the underlying material is exposed, and soils that are shallow.

This soil has low fertility. Available water holding capacity is about 3 to 5 inches. Runoff is rapid to very rapid, and the hazard of erosion is severe to very severe. The root zone is moderately deep.

This soil is used for range. Capability unit VIIe-1 (15); pasture and range site 9.

Los Gatos Series

The Los Gatos series consists of well-drained loamy soils that are underlain by moderately hard sandstone at a depth of 20 to 56 inches. These soils are moderately steep to steep and slightly eroded to moderately eroded. They are on uplands. The vegetation consists of annual grasses and forbs and of scattered to moderately thick stands of oaks on some north-facing slopes. Brush grows on a few of the more eroded areas. Elevations range from 300 to 1,200 feet above sea level. Annual rainfall is about 20 inches. The average annual temperature is about 57° F., and the frost-free period is about 260 days. The main associated soils are the Pinto, Soper, Sween, and San Benito.

The surface layer is brown to grayish-brown clay loam or rocky clay loam, 6 to 16 inches thick. The subsoil is brown clay loam 8 to 16 inches thick. The substratum is brownish-yellow clay loam that is 6 to 24 inches thick and is underlain by sandstone bedrock. Depth to sandstone is 20 to 56 inches in most places.

Los Gatos soils are used for dryland grain and pasture.

Los Gatos clay loam, 15 to 30 percent slopes (LvE).—This soil is moderately steep and occurs on rounded hills or on ridges and benches.

Representative profile: On hillside above pond, on Nyland Ranch, 400 yards northeast of State Route 156.

A1—0 to 13 inches, dark-brown (10YR 4/3) clay loam, dark brown (10YR 3/3) when moist; moderate, fine, granular structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, very fine, tubular pores, common, fine and medium, interstitial pores; medium acid; gradual, smooth boundary.

B2t—13 to 25 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few very fine and fine roots; common, very fine and fine, tubular pores; common stains of material from the A horizon on ped surfaces; some material from A horizon in larger pores; thin continuous clay films on surfaces of peds and larger pores; medium acid; clear, smooth boundary.

C—25 to 42 inches, brownish-yellow (10YR 6/6) clay loam, yellowish brown (10YR 5/6) when moist; moderate, fine, angular blocky structure; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; common, very fine and fine, tubular pores; many small fragments of sandstone; slightly acid; gradual, wavy boundary.

R—42 inches, moderately hard, weathered, fine-grained, acid, yellowish-brown sandstone.

Included with this soil are some small areas of San Benito and Sween soils, of soil that have a clay surface layer, and of soils that have more or less clay in the subsoil than Los Gatos soils.

This soil is moderately fertile. Available water holding capacity is 4 to 8 inches. Permeability is moderately slow, runoff is medium to rapid, and the hazard of erosion is moderate to severe. The root zone is moderately deep to deep.

This soil is used for dryland grain and pasture. Capability unit IVe-5 (15); pasture and range site 5.

Los Gatos clay loam, 30 to 50 percent slopes, eroded (LvF2).—This soil is similar to Los Gatos clay loam, 15 to 30 percent slopes, but it is steeper and more eroded. The average slope is about 45 percent. This soil has a brown surface layer in most places but ranges to grayish brown on north-facing slopes.

Included with this soil are small severely eroded areas, small gullied areas, a few rock outcrops, and small areas of San Benito, Sween, and Cotati soils. Also included are some soils that have more clay in the subsoil than Los Gatos soils.

Runoff is rapid to very rapid, and the hazard of erosion is severe to very severe. Available water holding capacity is 5 to 7 inches. The root zone extends to a depth of about 30 to 40 inches.

This soil is used for dryland pasture. Capability unit VIe-5 (15); pasture and range site 5.

Los Gatos rocky clay loam, 15 to 50 percent slopes, eroded (LwF2).—This soil is similar to Los Gatos clay loam, 15 to 30 percent slopes, but it is steeper, is eroded, has a thinner profile, and has 2 to 10 percent rock outcrops. It is moderately deep over sandstone. In most places it is moderately eroded, but it is severely eroded in some small areas. Slopes are dominantly 45 to 50 percent.

Included with this soil are some soils that are less than 20 inches deep over bedrock and some outcrops of sandstone that make up more than 10 percent of the area. Also included are some small areas of Gaviota and San Benito soils.

The root zone of this soil extends to a depth of 20 to 30 inches. Available water holding capacity is about 3 to 5 inches. Runoff is rapid to very rapid, and the hazard of erosion is severe to very severe.

This soil is used mostly for dryland pasture but is also used for watersheds, wildlife, and recreation. Capability unit VIs-5 (15); pasture and range site 5.

Metz Series

The Metz series consists of somewhat excessively drained sandy loams that are underlain by stratified, calcareous sand and gravel at a depth of 36 to 48 inches. These soils are nearly level to moderately sloping and occur on flood plains along the major drainageways. The vegetation consists chiefly of annual grasses and forbs, brush, and willows. Elevations range from 120 to 1,000 feet above sea level. Annual rainfall is 12 to 14 inches. The average annual temperature is about 60° F., and the frost-free period is about 260 days. The main associated soils are the Mocho and Sorrento.

The surface layer is grayish-brown sandy loam or gravelly sandy loam, 10 to 16 inches thick. The next layer is light brownish-gray sand 26 to 40 inches thick. Below this is stratified sandy and gravelly alluvium that extends to a depth of more than 5 feet. The amount of gravel in the profile varies.

Metz soils are used for irrigated apricots, walnuts, tomatoes, potatoes, and other vegetables and for dryland grain and incidental pasture.

Metz sandy loam, 0 to 2 percent slopes (MeA).—This soil occurs along the major drainageways. It is occasionally flooded.

Representative profile: On San Juan Farms; in young orchard, 300 yards past end of Flint Road; on first bottom.

Ap—0 to 8 inches, grayish-brown (2.5Y 5/2) sandy loam, very dark grayish brown (2.5Y 3/2) when moist; weak, fine, granular structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; few very fine and fine roots; few, very fine and fine, tubular pores; mildly alkaline, slightly effervescent; clear, smooth boundary.

A1—8 to 14 inches, grayish-brown (2.5Y 5/2) sandy loam, very dark grayish brown (2.5Y 3/2) when moist; weak, fine, subangular blocky structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; few very fine and fine roots; few, very fine and fine, interstitial pores; moderately alkaline, slightly effervescent; clear, wavy boundary.

C1—14 to 43 inches, light brownish-gray (2.5Y 6/2) sand, grayish brown (2.5Y 5/2) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; mildly alkaline, slightly effervescent; abrupt, smooth boundary.

C2—43 to 60 inches, light brownish-gray (2.5Y 6/2) stratified coarse sand and gravel, grayish brown (2.5Y 5/2) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; contains small lenses of silt and clay; mildly alkaline, slightly effervescent.

Included with this soil are small areas of Sorrento and Mocho soils.

This soil has low fertility. Available water holding capacity is about 5 to 6 inches. Permeability is rapid, runoff is very slow, and the hazard of erosion is slight to none. The root zone is very deep.

This soil is used for irrigated fruits, nuts, vegetables, row crops, field crops, dryland grain, and incidental pasture. Capability units IIs-4 (14) and IIIs-4 (15).

Metz gravelly sandy loam, 0 to 2 percent slopes (MgA).—This soil is similar to Metz sandy loam, 0 to 2 percent slopes, but its surface layer is gravelly. It occurs on first bottoms along large drainageways, and it is occasionally flooded.

Fine to medium gravel makes up 15 percent or more of the surface layer. Layers of gravel are also in the stratified material that underlies the surface layer. Available water holding capacity of this soil is 4 to 5 inches.

Included with this soil are areas that have a surface layer ranging from gravelly coarse sandy loam to gravelly loamy sand.

This soil is used for irrigated apricots, walnuts, tomatoes, and vegetables. Capability unit IIIs-4 (14).

Metz gravelly sandy loam, 2 to 9 percent slopes (MgC).—This soil is more sloping than Metz sandy loam, 0 to 2 percent slopes, and is gravelly throughout the profile. Fine to medium gravel makes up 15 percent or more of the profile. It occupies small areas along the large drainageways, and it is occasionally flooded. Slopes average 3 to 6 percent.

Included with this soil are areas that have a surface layer ranging from gravelly coarse sandy loam to gravelly loamy sand. Available water holding capacity is 3 to 4 inches. Runoff is slow to medium. The hazard of erosion is slight to moderate.

This soil is used for dryland grain and incidental pasture. Capability unit IIIe-4 (14).

Metz Series, Wet Variant

A wet variant from the Metz series has been mapped in this county. It formed in alluvium from a wide range of rocks and is very deep and somewhat poorly drained. This soil is nearly level; it lies on fans along Pacheco Creek. Elevations range from 120 to 150 feet above sea level. Annual rainfall is 12 to 14 inches. The average annual temperature is about 60° F., and the frost-free period is about 260 days. The main associated soils are the Metz, Mocho, and Sorrento.

The surface layer is pale-brown sandy loam 10 to 18 inches thick. The next layer, 22 to 30 inches thick, is light brownish-gray to pale-brown loamy sand to loamy fine sand that is mottled in the lower part. This material is stratified, and it contains thin layers of fine textured material in some places. Below this is the surface horizon of a buried soil that extends to a depth of more than 60 inches. Because this variant is flooded occasionally, it is covered with a thin overwash of variable texture. Also it contains a few pebbles throughout the profile.

This soil is used for irrigated fruits, nuts, and row crops.

Metz sandy loam, wet variant, 0 to 2 percent slopes (MhA).—This nearly level soil occurs on fans along Pacheco Creek. It is flooded occasionally and receives deposits of sediment.

Representative profile: Three-quarters mile west on Lovers Lane, north of Pacheco Creek; 200 feet from the end of the levee.

Ap—0 to 9 inches, pale-brown (10YR 6/3) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful fine to medium roots; common, medium, interstitial pores; mildly alkaline clear, smooth boundary.

A1—9 to 18 inches, pale-brown (10YR 6/3) sandy loam, very dark grayish brown (10YR 3/2) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful fine to medium roots; common, medium, interstitial pores; mildly alkaline; clear, smooth boundary.

C1—18 to 24 inches, light brownish-gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; plentiful fine to medium roots; moderately alkaline; clear, smooth boundary.

C2—24 to 50 inches, light brownish-gray (10YR 6/2) loamy fine sand, brown (10YR 4/3) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; few medium roots; few, fine, prominent mottles of strong brown to reddish yellow (7.5YR 5/6 to 7/6); slightly calcareous; moderately alkaline; clear, smooth boundary.

IIAbg—50 to 60 inches, gray (10YR 5/1) loam, dark gray (10YR 4/1) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common, fine, prominent mottles of reddish brown to dark reddish brown (5YR 5/4 to 3/4); strongly calcareous, moderately alkaline.

This soil has low fertility. Available water holding capacity is about 5 to 6 inches. Permeability is rapid, runoff is very slow, and the hazard of erosion is slight to none. The root zone is very deep.

This soil is used for irrigated fruits, nuts, and row crops. Capability unit IIw-2 (14).

Mine Pits and Dumps

Mine pits and dumps (MnG) consists of limestone, marble, and granite quarries; sand and gravel pits; open-pit and deep shaft mines; and dumps of waste materials. The areas are generally bare, but a few of the older quarries have a thin cover of grass and forbs. Drainage is generally excessive, runoff is rapid, and silt production is high. Capability unit VIIIs-1 (15).

Mocho Series

The Mocho series consists of well-drained loamy soils that formed in stratified, calcareous alluvium washed from sedimentary rocks. These soils are nearly level to sloping and occupy flood plains along the larger drainageways. The vegetation consists of annual grasses and forbs and scattered oaks. Elevations range from 120 to 1,000 feet above sea level. Annual rainfall is 12 to 16 inches. The average annual temperature is about 60° F., and the frost-free period is about 275 days. The main associated soils are the Metz and Sorrento.

The surface layer is grayish-brown loam about 18 inches thick. It is loam, gravelly loam, sandy loam, or clay loam. The next layer, 36 to 60 inches thick, is light brownish-gray loam and fine sandy loam. Beneath this, at a depth greater than 60 inches, is stratified calcareous sand, gravel, and finer textured materials.

Mocho soils are used for irrigated fruits, nuts, row crops, and field crops and for dryland grain and incidental pasture.

Mocho loam, 0 to 2 percent slopes (MpA).—This soil occurs on fans and along major drainageways. It is subject to occasional flooding in some areas.

Representative profile: 200 yards to west of right angle bend in Cienega Road, 1 mile south of the junction of the Cienega Road and old State Route 25.

Ap—0 to 11 inches, grayish-brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) when moist; moderate, fine, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; common, fine and medium, interstitial pores; moderately alkaline, slightly effervescent; clear, smooth boundary.

A1—11 to 18 inches, grayish-brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; common, very fine and fine, tubular pores; moderately alkaline, strongly effervescent; clear, smooth boundary.

C1—18 to 29 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; many, very fine and fine, tubular pores; stratified, small, sand pockets; moderately alkaline, strongly effervescent; clear, wavy boundary.

IIC2—29 to 72 inches, light brownish-gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common, very fine and fine, tubular pores; stratified thin layers of sand and lenses of fine material with brown decayed organic material between strata; moderately alkaline, strongly effervescent; gradual, wavy boundary.

Included with this soil are some small areas of Sorrento soils and of clayey soils.

This soil is fertile. Available water holding capacity is 8 to 10 inches. Permeability is moderate, runoff is very slow, and the hazard of erosion is none to slight. The root zone is very deep.

This soil is used for irrigated apricots, prunes, walnuts, alfalfa, sugar beets, potatoes, tomatoes, and other vegetables and for dryland grain and incidental pasture. Capability units I–1 (14) and IIIc–1 (15).

Mocho loam, 2 to 9 percent slopes (MpC).—This soil is similar to Mocho loam, 0 to 2 percent slopes, but it is more sloping. Slopes dominantly are 3 to 5 percent. Areas along major drainageways are occasionally flooded. A few fine to medium pebbles occur in the profile. Gravelly layers occur in the underlying material.

Included with this soil are a few areas that have a surface layer ranging from silt loam to light clay loam. Also included are small moderately eroded areas. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for irrigated prunes, apricots, walnuts, grapes, alfalfa, sugar beets, and vegetables and for dryland grain and incidental pasture. Capability units IIe–1 (14) and IIIe–1 (15).

Mocho gravelly loam, 2 to 5 percent slopes (MrB).—This soil is similar to Mocho loam, 0 to 2 percent slopes, but it is more sloping and is gravelly throughout the profile. The content of gravel is generally 20 percent or more by volume.

Included are areas that have a surface layer ranging from gravelly silt loam to gravelly clay loam.

Available water holding capacity is about 8 inches. Runoff is slow, permeability is moderately rapid, and the hazard of erosion is slight.

This soil is used for irrigated walnuts, apricots, and alfalfa, and for dryland grain and incidental pasture. Capability unit IIe–1 (14).

Mocho clay loam, 2 to 9 percent slopes (MsC).—This soil is similar to Mocho loam, 0 to 2 percent slopes, but it is more sloping and is finer textured throughout the profile. Slopes generally range from 3 to 6 percent. Generally the underlying material is finer textured than normal for the series and ranges from loam to silty clay loam. Most areas of this soil are not subject to flooding.

Included with this soil are small areas that have a clay or silty clay loam surface layer.

Available water holding capacity is about 10 to 12 inches. Permeability is moderately slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for irrigated grapes and alfalfa and for dryland grain and incidental pasture. Capability units IIe–5 (14) and IIIe–5 (15).

Mocho sandy loam, 0 to 2 percent slopes (MoA).—This soil is similar to Mocho loam, 0 to 2 percent slopes, but it has a sandy loam surface layer. It occurs on high first bottoms and is seldom flooded. It contains a few fine to medium pebbles and has gravelly layers in the underlying material generally below a depth of 50 inches. Available water holding capacity is about 9 inches. Permeability is moderately rapid.

This soil is used for irrigated fruits, nuts, and vegetables and for dryland grain and incidental pasture. Capability units I–1 (14) and IIIc–1 (15).

Mocho sandy loam, 2 to 9 percent slopes (MoC).—This soil is similar to Mocho loam, 0 to 2 percent slopes, but it has a sandy loam surface layer and is more sloping. It occurs as small areas along major drainageways. Slopes are dominantly 3 to 6 percent. Many areas are high enough to escape flooding, but some areas are subject to occasional flooding. In some places water concentrated on the surrounding hills has cut rills and gullies through this soil. The soil contains a few fine to medium pebbles, and the underlying material contains gravelly layers in some places.

Available water holding capacity is about 9 inches. Permeability is moderately rapid, runoff is medium, and the hazard of erosion is moderate.

This soil is used for irrigated alfalfa and for dryland grains and incidental pasture. Capability units IIe–1 (14) and IIIe–1 (15).

Montara Series

The Montara series consists of somewhat excessively drained loamy soils that are underlain by serpentine or serpentinized bedrock at a depth of 4 to 20 inches. These soils occupy hilly and mountainous uplands and are moderately steep to steep. The vegetation consists of annual grasses and forbs or brush and scattered oaks and Digger pine. Elevations range from 800 to 3,000 feet above sea level. Annual rainfall is 12 to 16 inches. Average annual temperature is about 60° F., and the frost-free period is about 250 days. The main associated soils are the Cibo, Diablo, Gazos, San Benito, Vallecitos, and Climara.

The surface layer is gray rocky silty clay loam 4 to 20 inches thick. In most places it is 10 to 18 inches thick. The underlying bedrock is weathered, fractured, serpentine and serpentinized rocks. Bedrock outcrops cover 2 to 10 percent of the area.

Montara soils are used for range and watersheds, wildlife, and recreation.

Montara rocky silty clay loam, 15 to 50 percent slopes, eroded (MtF2).—This soil is moderately steep to steep and occurs in the uplands. Rocks crop out in 2 to 10 percent of the areas.

Representative profile: North of the Panoche Valley Road, one-half mile northeast of Emmet School.

A11—0 to 7 inches, gray (5Y 5/1) rocky silty clay loam, very dark gray (5Y 3/1) when moist; strong, fine, granular structure; hard when dry, friable when moist, sticky and plastic when wet; abundant very fine and fine roots; common, fine and medium, interstitial pores; neutral; clear, smooth boundary.

A12—7 to 12 inches, gray (5Y 5/1) silty clay loam, very dark gray (5Y 3/1) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; few very fine and fine roots; few, very fine and medium, tubular pores, common, fine and medium, interstitial pores; mildly alkaline, slightly effervescent; clear, wavy boundary.

R—12 inches, highly weathered, highly fractured, greenish-gray (5G 6/1) serpentine; lime coatings on fragments.

Included with this soil are small areas of Cibo and Climara soils and of severely eroded areas.

This soil has low fertility, is deficient in calcium, and has a low calcium-magnesium ratio. Available water holding capacity is 1 to 3 inches. Permeability is moderately slow, runoff is rapid to very rapid, and the hazard of erosion is severe to very severe. The root zone is shallow over bedrock.

The soil is used for range. Capability unit VIIs–9 (15); pasture and range site 8.

Nacimiento Series

The Nacimiento series consists of well-drained loamy soils that are underlain by calcareous sandstone and shale. These soils occupy hilly and mountainous uplands and are strongly sloping to very steep. The vegetation consists of annual grasses, forbs, and scattered oaks. Brush grows on the more eroded slopes. Elevations range from 1,200 to 3,000 feet above sea level. Annual rainfall is 12 to 16 inches. Average annual temperature is about 60° F., and the frost-free period is about 260 days.

The surface layer is brown to yellowish-brown clay loam to loam 10 to 20 inches thick. The next layer is pale-brown to light yellowish-brown clay loam that averages 10 to 40 inches in thickness. Below this is weathered, yellowish-brown, calcareous, medium-grained sandstone and shale. Depth to sandstone and shale ranges from 20 to 60 inches.

Nacimiento soils are used for dryland grain and pasture and for range.

Nacimiento clay loam, 30 to 50 percent slopes, eroded (NaF2).—This steep soil occurs on hills with narrow, winding ridgetops. In most places it is moderately eroded, but it is severely eroded in a few small areas.

Representative profile: On hillside to west of State Route 25, about 2 miles south of Topo Valley.

A1—0 to 13 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) when moist; moderate, fine, granular structure; slightly hard when dry, very friable when moist, sticky and plastic when wet; plentiful very fine and fine roots; common, very fine and fine, interstitial pores; moderately alkaline, strongly effervescent; gradual, smooth boundary.

C1ca—13 to 24 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, sticky and plastic when wet; few very fine and fine roots; few, very fine, tubular pores, common, very fine and fine, interstitial pores; many, fine and medium, lime seams and coatings on ped surfaces and in larger pores; moderately alkaline, violently effervescent; gradual, smooth boundary.

C2ca—24 to 40 inches, light yellowish-brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) when moist; weak subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; common, fine and medium, interstitial pores; many, fine and medium, lime seams and coatings on ped surfaces and in larger pores, few, small, soft masses of lime; moderately alkaline, violently effervescent; gradual, wavy boundary.

C3—40 to 60 inches, highly weathered, highly calcareous, yellowish-brown (10YR 5/6), medium-grained sandstone and shale.

Included with this soil are some small areas of Kettleman and San Benito soils. Also included are some rock outcrops and Landslides.

This soil is moderately fertile. Available water holding capacity is about 5 to 8 inches. Permeability is moderately slow, runoff is rapid to very rapid, and the hazard of erosion is severe to very severe. Depth to bedrock is 20 to 48 inches.

This soil is used for dryland pasture and for watersheds and wildlife. Capability unit VIe-5 (15); pasture and range site 1.

Nacimiento clay loam, 9 to 15 percent slopes (NaD).—This soil is similar to Nacimiento clay loam, 30 to 50 percent slopes, eroded, but it is less sloping, is not eroded or is only slightly eroded, and is deeper over bedrock. Depth to bedrock is 40 to 60 inches. This soil occurs on small upland benches, on broad ridges, or on toe slopes in areas of moderately steep to very steep soils. It is generally grayish brown and is only slightly calcareous in the surface layer.

Available water holding capacity is 8 to 10 inches. Runoff is medium, and the hazard of erosion is moderate. The root zone is deep.

This soil is used for dryland grain and pasture. Capability unit IIIe-5 (15); pasture and range site 1.

Nacimiento clay loam, 15 to 30 percent slopes (NaE).—The soil is similar to Nacimiento clay loam, 30 to 50 percent slopes, eroded, but it is less sloping and is only slightly eroded. It occurs on hills or on broad rounded ridgetops in areas of steep and very steep soils. Runoff is medium to rapid, and the hazard of erosion is moderate to severe.

Included with this soil are small areas of soils that have a clay surface layer.

This soil is used mostly for dryland pasture. Capability unit IVe-5 (15); pasture and range site 1.

Nacimiento clay loam, 50 to 75 percent slopes, eroded (NaG2).—This soil is similar to Nacimiento clay loam, 30 to 50 percent slopes, eroded, but it is steeper and is shallower over bedrock. Depth to bedrock is 20 to 30 inches. This soil is very steep and occupies mountainous areas or breaks in areas of moderately steep or steep soils. Slopes are dominantly between 55 and 60 percent.

Outcrops of sandstone and shale are commonly included and make up as much as 15 percent of the surface. Also included are small Landslides, Sedimentary rock land, areas of very thin soils, and small areas of San Benito and Linne soils. Other inclusions are severely eroded areas and soils that have a surface layer ranging from sandy clay loam to loam. Available water holding capacity is about 4 to 5 inches.

Runoff is very rapid, and the hazard of erosion is very severe. The root zone is moderately deep.

This soil is used for range and for watersheds, wildlife, and recreation. Capability unit VIIe-5 (15); pasture and range site 1.

Nacimiento loam, 30 to 75 percent slopes, severely eroded (NcG3).—The surface layer of this loam ranges from grayish brown to yellowish brown but is brown to yellowish brown in areas where the underlying material has been exposed. Reaction ranges from neutral to moderately alkaline, depending on the content of lime in the underlying material, but most areas are moderately alkaline and calcareous. Slopes are dominantly 45 to 60 percent. A moderate to large amount of silt is washed from this severely eroded soil.

Included with this soil are some areas of rock outcrops and some large and small Landslides. Also included are small areas of soils deeper than this Nacimiento soil and areas of Nacimiento soils that have a surface layer as fine textured as light clay loam.

This soil has low fertility. Available water holding capacity is 2 to 3 inches. Runoff is rapid to very rapid, and the hazard of erosion is severe to very severe.

This soil is used for watersheds, wildlife, and recreation. Capability unit VIIIe-1 (15).

Pacheco Series

The Pacheco series consists of somewhat poorly drained, loamy soils that are underlain by stratified alluvium at depths greater than 50 inches. These soils are nearly level and occupy low flood plains or fans. Areas along the major drainageways are subject to occasional flooding and deposition. The vegetation consists mainly of annual grasses and forbs, but some cottonwoods and willows grow along drainageways. Elevations range from 150 to 400 feet above sea level. Annual rainfall is 12 to 14 inches. Average annual temperature is about 60° F., and the frost-free period is about 260 days. The main associated soils are the Clear Lake, Sorrento, and Willows.

The surface layer is dark-gray to grayish-brown silt loam, loam, clay loam, or silty clay 20 to 24 inches thick. The subsoil is grayish-brown to light brownish-gray clay loam that ranges from 12 to 20 inches in thickness. In places the subsoil and the substratum are mottled. The substratum is brown to yellowish-brown clay loam that is generally stratified below a depth of 50 inches. It ranges from clay loam to silt loam and contains lenses of loamy sand and gravel in some places. Most areas have a water table that is seasonally high and is within a depth of 36 to more than 60 inches. Some areas are moderately to severely affected by alkali.

Pacheco soils are used for irrigated walnuts, prunes, pears, sugar beets, tomatoes, vegetables, and alfalfa and for dryland grain and pasture.

Pacheco silt loam (0 to 2 percent slopes) (Pa).—This soil occurs on nearly level flood plains.

Representative profile: On Sabbatini Ranch, in alfalfa field, 60 yards to the rear (north) of Pacheco School, on the northwest corner of Shore Road and Lovers Lane.

Ap—0 to 9 inches, dark-gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) when moist; moderate, fine, granular structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, very fine and fine, tubular pores, common, fine, interstitial pores; moderately alkaline; clear, smooth boundary.

A1—9 to 20 inches, dark-gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) when moist; moderate, medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, very fine and fine and few, medium, tubular pores, common, very fine and fine, interstitial pores; moderately alkaline; slightly effervescent; gradual, smooth boundary.

IIB2—20 to 32 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, subangular blocky structure; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; many, very fine and fine, tubular pores; intermittent films of material from the A horizon on ped surfaces; ped surfaces gray and dark gray (10YR 5/1 when dry, 10YR 4/1 when moist); moderately alkaline, strongly effervescent; gradual, smooth boundary.

IIC1—32 to 64 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; many, very fine, fine, medium, tubular pores; thick gleyed layers (N 6/0 when dry, N 4/0 when moist) on ped and pore surfaces; moderately alkaline, strongly effervescent; gradual, smooth boundary.

IIC2—64 to 105 inches, yellowish-brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) when moist, with coarse distinct mottles of gray and dark gray (N 6/0 when dry, N 4/0 when moist); weak, medium, subangular blocky structure; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; common, very fine, fine, and medium, tubular pores; stratified with thin layers of loamy sand; moderately alkaline, slightly effervescent.

Included with this soil are small areas that have slopes up to 4 percent and small areas of Willows and Clear Lake soils. Also included are some areas of soils that lie at higher elevations than Pacheco soils and that formed mainly in alluvium washed from soils on granite bedrock.

This soil is moderately fertile. Available water holding capacity is about 10 to 12 inches. Permeability is moderately slow, runoff is very slow to ponded, and erosion is not a hazard. Small areas are moderately to severely affected by alkali. In most places the water table has been lowered to a depth below 60 inches by pumping and artificial drainage, but in a few areas the water table is within a depth of 36 to 60 inches. The root zone is very deep.

The soil is used for irrigated alfalfa, and sugar beets, and dryland pasture. Capability unit IIw-2 (14); pasture and range site 11.

Pacheco loam (0 to 2 percent slopes) (Pc).—This soil is similar to Pacheco silt loam, but its texture is loam throughout. It has a grayish-brown to dark-gray loam surface layer and a loam subsoil. The substratum is generally stratified loam to clay loam and contains lenses of loamy sand and gravel. Some areas have fine gravel throughout the solum.

Included with this soil are small areas of soils that have a pale-brown surface layer and of some soils that have a loamy sand overwash on the surface. Also included are some small areas of soil at higher elevations than this Pacheco soil and that formed in alluvium washed mainly from soils on granitic bedrock. This included soil overlies buried soils that are at a depth of about 30 inches or more.

Available water holding capacity is about 8 to 10 inches. Permeability is moderate.

This soil is used for irrigated walnuts, apricots, sugar beets, tomatoes, and alfalfa and for dryland grain and incidental pasture. Capability unit IIw-2 (14).

Pacheco clay loam over clay (0 to 2 percent slopes) (Pd).—This soil consists of 20 to 36 inches of grayish-brown clay loam over dark gray clay. The surface layer is mildly alkaline to moderately alkaline and is slightly calcareous in a few areas. It has a few fine to medium pebbles in some areas. It occurs in San Juan and Hollister Valleys, generally to the north of Hollister.

This soil is moderately fertile. Available water holding capacity is 8 to 10 inches.

This soil is used for irrigated fruits and nuts, sugar beets, and vegetables and for dryland grain and incidental pasture. Capability unit IIw-2 (14).

Pacheco Silty clay (0 to 2 percent slopes) (Pe).—This soil is similar to Pacheco silt loam, but it has a silty clay surface layer about 15 inches thick over a clay loam subsoil. It occurs in small areas close to drainageways or in sloping areas around and in depressions. In places this soil is stratified with lenses of silt loam to loamy sand at depths greater than 50 inches. The water table is generally below a depth of 60 inches, but in small areas it is within a depth of 36 inches.

This soil has been drained, and the water table has been lowered. Available water holding capacity is 10 to 12 inches.

This soil is used for irrigated fruit and nut trees, field and row crops, and alfalfa (fig. 10). Capability unit IIs–5 (14).

Panhill Series

The Panhill series consists of well-drained loamy soils that are underlain by stratified, gravelly, calcareous alluvium at a depth of 4 to 5 feet. These soils are gently sloping and lie in the Panoche and Vallecitos Valleys. They occupy fans and terraces below Kettleman soils, depressions in the uplands, and the floors of small valleys in the uplands. The vegetation consists of annual grasses and forbs and some desert shrubs. Elevations range from 1,200 to 2,000 feet above sea level. Annual rainfall is 5 to 10 inches. Average annual temperature is about 63° F., and the frost-free period is about 260 days The main associated soils are the Kettleman and Panoche.

The surface layer is pale-brown to light yellowish-brown loam 12 to 18 inches thick. The subsoil is light yellowish-brown loam 11 to 16 inches thick. The substratum consists of 20 to 30 inches of light yellowish-brown loam over strata of gravel and fine-textured material. The gravelly alluvium is calcareous and extends to an undetermined depth. Fine and medium gravel generally occurs throughout the profile.

Panhill soils are used for range.

Panhill loam, 2 to 9 percent slopes (PhC).—This soil occurs on fans with gilgai microrelief. Slopes are dominantly 4 to 8 percent. In some areas deep gullies or drainageways have been cut by water from surrounding hills.

Representative profile: On fan at base of hills one-third mile west of Little Panoche Road, 2 miles north of junction with Panoche Road.

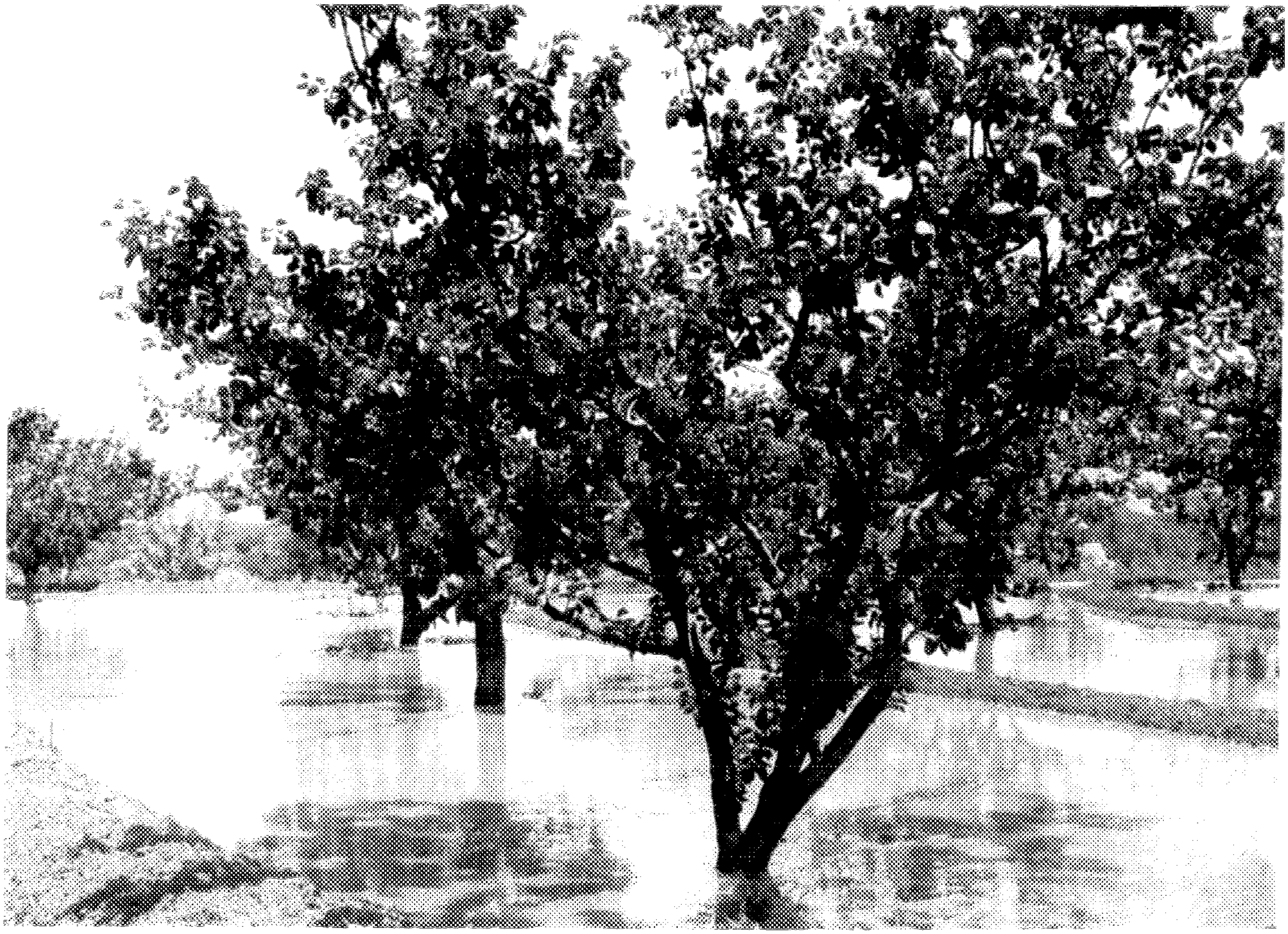

Figure 10.—Contour basin irrigation (a form of flood irrigation) in an apricot orchard on Pacheco silty clay.

A11—0 to 1 inch, pale-brown (10YR 6/3) loam, brown (10YR 4/3) when moist; moderate, thin platy structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; common, very fine and fine, tubular pores; neutral; abrupt, smooth boundary.

A12—1 to 17 inches, light yellowish-brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; common, very fine, fine, and medium, tubular pores; neutral; gradual, smooth boundary.

B2t—17 to 28 inches, light yellowish-brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; many, very fine and medium, tubular pores; very few, thin, patchy clay films in larger pores; mildly alkaline; gradual, smooth boundary.

C1—28 to 60 inches, light yellowish-brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; many, very fine and fine, tubular pores; few fine pebbles; soft lime in seams and small masses; moderately alkaline, strongly effervescent; gradual, smooth boundary.

Included with this soil are some small areas of Panoche soils and some soils that have a clay loam or clay surface layer. Also included are some soils that have slightly more clay in the subsoil and small areas of soils that are calcareous at the surface.

This soil is moderately fertile. Available water holding capacity is about 9 to 11 inches. Permeability is moderate, runoff is slow to medium, and the hazard of erosion is slight to moderate. The root zone is very deep.

This soil is used for range. Capability unit VIIc-1 (15); pasture and range site 10.

Panoche Series

The Panoche series consists of well-drained loamy soils that formed in alluvium derived from sedimentary rocks. These soils are on nearly level to moderately sloping flood plains and fans in the Panoche and Vallecitos Valleys in the southeastern part of the county. The vegetation consists of annual grasses and forbs and a few cottonwoods and willows along the larger drainageways. Elevations range from 1,200 to 2,000 feet above sea level. Annual rainfall is 5 to 10 inches. Average annual temperature is about 64° F., and the frost-free period is about 265 days. The main associated soils are the Docas, Panhill, and Kettleman.

The surface layer is about 12 inches thick. It is pale-brown or brown to light brownish-gray or light yellowish-brown loam or sandy loam. The next layer is pale-brown to light yellowish-brown, calcareous loam 27 to 50 inches thick. Below this is brown, calcareous loam that extends to an undetermined depth. The lower part of this layer ranges from loam to silty clay loam and is lighter colored than the upper part. It is stratified with sand and gravel in some places.

Panoche soils are used for irrigated cotton, safflower, and alfalfa and for range.

Panoche loam, 0 to 2 percent slopes (PlA).—This soil occurs along drainageways.

Representative profile: In barley field, on Recalde Ranch in Panoche Valley; 500 yards southeast of house.

Ap—0 to 8 inches, pale-brown (10YR 6/3) loam, brown (10YR 4/3) when moist; moderate, fine, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; common, very fine, tubular pores, common, fine, interstitial pores; mildly alkaline, slightly effervescent; clear, smooth boundary.

A1—8 to 12 inches, pale-brown (10YR 6/3) loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; common, very fine, tubular pores and common, fine, interstitial pores; moderately alkaline, strongly effervescent; clear, smooth boundary.

C1—12 to 29 inches, pale-brown (10YR 6/3) loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; many, very fine, fine, and medium, tubular pores; common, small, soft masses of lime; moderately alkaline, violently effervescent; clear, smooth boundary.

C2—29 to 39 inches, light yellowish-brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) when moist; weak, fine, subangular block structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; many, very fine and fine, tubular pores; common, small, soft masses of lime; moderately alkaline, violently effervescent; clear, smooth boundary.

C3—39 to 76 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) when moist; weak, fine, subangular blocky structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; few, very fine and fine, tubular pores; common, small, soft masses of lime, stratified; moderately alkaline, violently effervescent; clear, smooth boundary.

Included with this soil are small areas of Panhill soils and some soils that have a loamy sand or light clay surface layer.

This soil is moderately fertile. Available water holding capacity is 9 to 11 inches. Permeability is moderate, runoff is very slow, and the hazard of erosion is slight to none.

This soil is used for irrigated cotton, safflower, and alfalfa and for range. Capability units I-1 (17) and VIIc-1 (15); pasture and range site 10.

Panoche loam, 2 to 9 percent slopes (PlC).—This soil is similar to Panoche loam, 0 to 2 percent slopes, but it is more sloping. It occupies fans and bottom land along the drainageways and in valleys. Slopes are dominantly 3 to 6 percent. The soil ranges from light brownish gray to light yellowish brown, but it is generally pale brown. The lower part of the substratum is generally somewhat stratified and contains gravel in some places.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for irrigated safflower, cotton and alfalfa and for range. Capability units IIe-1 (17) and VIIc-1 (15); pasture and range site 10.

Panoche sandy loam, 0 to 2 percent slopes (PkA).—This soil is similar to Panoche loam, 0 to 2 percent slopes, but it has a sandy loam surface layer. It occurs along drainageways in Panoche Valley. Drainageways through areas of this soil are generally deeply cut and have nearly vertical walls. This soil is generally pale brown but ranges to light brownish gray in some places. The lower part of the substratum is stratified sandy loam to loamy sand and contains strata of gravel in some places. Available water holding capacity is 8 to 10 inches.

This soil is used for irrigated cotton, safflower, and alfalfa and for range. Capability units I-1 (17) and VIIc-1 (15); pasture and range site 10.

Panoche sandy loam, 2 to 9 percent slopes (PkC).—This soil is similar to Panoche loam, 0 to 2 percent slopes, but it has a sandy loam surface layer and is more sloping. It generally occurs in small to medium areas within areas of nearly level soils or on small to medium fans that lead from the base of the hills to the valley floors. Slopes are generally 3 to 6 percent but range to 9 percent on a few of the fans. The soil is generally pale brown to light yellowish brown and is stratified in the lower part of the substratum.

Included with this soil are some soils that have a loamy sand surface layer.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for irrigated cotton, safflower, and alfalfa and for range. Capability units IIe-1 (17) and VIIc-1 (15); pasture and range site 10.

Pinnacles Series

The Pinnacles series consists of well-drained to somewhat excessively drained loamy soils that are underlain by semiconsolidated, coarse, arkosic sandstone. These soils have a loamy surface layer and a clayey subsoil. They are moderately steep to very steep. The vegetation consists of grasses and forbs, scattered oaks and Digger pine, and some areas of brush. Elevations range from 1,000 to 3,000 feet above sea level. Annual rainfall is 14 to 18 inches. Average annual temperature is about 60° F., and the frost-free period is about 250 days. The main associated soils are the Auberry, Sheridan, Santa Lucia, and Laniger.

The surface layer is 8 to 22 inches thick. It is generally brownish-gray to brown coarse sandy loam. The subsoil consists of brown coarse sandy clay and light yellowish-brown coarse sandy clay loam 12 to 20 inches thick. It is underlain by coarse, semiconsolidated, arkosic sandstone that is gravelly in most places. Depth to sandstone ranges from 20 to 42 inches.

Pinnacles soils are used for pasture, range, watersheds, wildlife, and recreation.

Pinnacles coarse sandy loam, 30 to 75 percent slopes, severely eroded (PnG3).—This steep to very steep soil occurs in areas of narrow winding ridges. Slopes are dominantly 40 to 60 percent. Landslides form deep nearly vertical escarpments in many places.

Representative profile: Jef Schmidt Ranch in Horse Valley, 2 miles east of the Pinnacles National Monument, and 3 miles west of State Route 25; in Dry Lake Valley. In the SE. corner of section 8, T. 16 S., R. 8 E., Mt. Diablo Base and Meridian.

A11—0 to 8 inches, light brownish-gray (10YR 6/2) coarse sandy loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, granular structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, very fine and fine, interstitial pores; medium acid; clear, smooth boundary.

A12—8 to 12 inches, light brownish-gray (10YR 6/3) coarse sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; common, fine and medium, interstitial pores; medium acid; abrupt, smooth boundary.

B2t—12 to 22 inches, brown (7.5YR 5/4) coarse sandy clay, dark brown (7.5YR 4/4) when moist; strong, coarse, prismatic structure that breaks readily to strong, medium, angular blocky structure; very hard when dry, very firm when moist, sticky and plastic when wet; few very fine and fine roots; common, very fine and fine, tubular pores; thin continuous and moderately thick patchy clay films on ped and pore surfaces; strongly acid; clear, smooth boundary.

B3—22 to 25 inches, light yellowish-brown (10YR 6/4) sandy clay loam, dark yellowish brown (10YR 4/4) when moist; moderate, fine subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; strongly acid; gradual, smooth boundary.

R—25 inches, semiconsolidated, acid, coarse-grained, gravelly arkosic sandstone of the Temblor formation.

Included with this soil are small areas of Laniger, Sheridan, and Auberry soils. Also included are small areas of soils that have a gravelly surface layer and soils that have less clay in the subsoil than Pinnacles soils.

This soil has low fertility. Available water holding capacity is about 3 to 6 inches. Permeability is slow, runoff is rapid to very rapid, and the hazard of erosion is very severe. The root zone is moderately deep.

This soil is used for range, wildlife, watersheds, and recreation. Capability unit VIIe-1 (15); pasture and range site 3.

Pinnacles coarse sandy loam, 15 to 30 percent slopes, eroded (PnE2).—This soil is similar to Pinnacles coarse sandy loam, 30 to 75 percent slopes, severely eroded, but it has a slightly thicker profile, is only moderately steep, and is only moderately eroded. It occurs on moderately steep hills and ridgetops. Color ranges from brown to grayish brown. Some areas have been gullied by water from the surrounding hills.

Included with this soil are small areas of coarse sandy clay loams, of gravelly soils, and of soils that are less sloping and have a slightly thicker solum.

This soil is well drained. Runoff is rapid, and the hazard of erosion is severe. The root zone is moderately deep to deep.

This soil is covered by grass or grass and brush and is used for dryland pasture. Capability unit VIe-3 (15); pasture and range site 3.

Pinto Series

The Pinto series consists of well-drained loamy soils that are underlain by a weakly cemented hardpan at a depth of 24 to 38 inches. These soils are moderately steep and occupy uplands. The vegetation consists of grasses and forbs, plantings of eucalyptus, and areas of ferns. Elevations are 400 to 800 feet above sea level. Annual rainfall is 16 to 20 inches. Average annual temperature is about 58° F., and the frost-free period is about 250 days. The main associated soils are the Arnold and Metz.

The surface layer is brown sandy loam 6 to 12 inches thick. The subsoil is reddish-brown heavy sandy loam 18 to 26 inches thick. The hardpan consists of 24 to 38 inches of reddish-brown weakly cemented sandy loam that is underlain by brown to yellowish-brown, slightly hard, medium-grained, acid terrace material.

Pinto soils are used for dryland pasture.

Pinto sandy loam, 15 to 30 percent slopes, eroded (PsE2).—This soil occurs on moderately steep ridgetops in areas of other soils.

Representative profile: On hillside, three-quarter mile northeast of auction farm on north side of U.S. Highway No. 101.

A—0 to 8 inches, brown (7.5YR 5/2) sandy loam, dark brown (7.5YR 3/2) when moist; weak, fine, granular structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; common, very fine and fine, interstitial pores; strongly acid; clear, smooth boundary.

B21t—8 to 16 inches, reddish-brown (5YR 5/4) heavy sandy loam, dark reddish brown (5YR 3/4) when moist; weak, coarse, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; common, very fine and fine, interstitial pores; thin patchy clay films on ped surfaces and in pores; strongly acid; gradual, smooth boundary.

B22t—16 to 29 inches, reddish-brown (5YR 5/3) heavy sandy loam, dark reddish brown (5YR 3/3) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; many, very fine, and few, fine and medium, interstitial pores; thin patchy clay films on ped surfaces and in pores; strongly acid; gradual, wavy boundary.

C1—29 to 63 inches, reddish-brown (5YR 5/4) sandy loam, weakly cemented with silica, dark reddish brown (5YR 3/4) when moist; common, medium, distinct mottles of pink (7.5YR 7/4) and brown (7.5YR 5/4) when moist; massive; few very fine and fine roots; few, fine and medium, iron and manganese concretions; strongly acid; diffuse, smooth boundary.

C2—63 inches, brown to yellowish-brown, (10YR 5/3 to 5/4) slightly hard, medium-grained, acid terrace material.

Included with this soil are some small areas of Arnold soils. This soil is low in fertility. Available water holding capacity is about 3 to 5 inches. Permeability is slow. Runoff is rapid, and the hazard of erosion is severe. Hardpan is at a moderate depth, and it limits the penetration of roots and water.

This soil is used for dryland pasture. Capability unit VIe-1 (15); pasture and range site 3.

Pleasanton Series

The Pleasanton series consists of well-drained loamy and gravelly loamy soils that are underlain by stratified alluvium at a depth of more than 48 inches. These soils are gently sloping to moderately sloping, and they occupy terraces or fans of alluvium derived from sandstone and shale. The vegetation consists of annual grasses and forbs and scattered oaks. Elevations are less than 1,000 feet above sea level. Annual rainfall is 12 to 14 inches. The average annual temperature is about 59° F., and the frost-free period is about 250 days. The main associated soils are the Antioch, Rincon, and Soper.

The surface layer is brown to grayish-brown loam or gravelly loam about 16 to 24 inches thick. The subsoil is brown clay loam 20 to 24 inches thick. It contains some gravel and generally is more gravelly as depth increases. The substratum is light yellowish-brown clay loam that is underlain by stratified alluvium below a depth of 48 inches. The stratified material consists of lenses of sand, gravel, and clay that are intermittently calcareous.

Pleasanton soils are used mainly for dryland grain and pasture. In a few areas irrigated grapes are grown.

Pleasanton loam, 2 to 5 percent slopes (PtB).—This soil is adjacent to drainageways.

Representative profile: East of Panoche Valley Road; road cut 200 yards southeast of the junction of Panoche Valley Road and Browns Valley Road.

Ap—0 to 9 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) when moist; moderate, fine, granular structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, very fine and fine, interstitial pores; slightly acid; clear, smooth boundary.

A1—9 to 21 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; many, very fine and fine, tubular pores; neutral; clear, smooth boundary.

B21t—21 to 33 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) when moist; moderate, fine, angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; plentiful very fine and fine roots; common, very fine and fine, tubular pores; thin patchy clay films on the surfaces of peds and larger pores; neutral; clear, smooth boundary.

IIB22t—33 to 45 inches, brown (10YR 5/3) very gravelly clay loam, dark brown (10YR 3/3) when moist; weak, fine, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few very fine and fine roots; common, very fine and fine, tubular pores; few, thin, patchy clay films on ped surfaces; mildly alkaline; clear, smooth boundary.

IIIC1—45 to 55 inches, light yellowish-brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few, very fine and fine, tubular pores; mildly alkaline; clear, smooth boundary.

IVC2—55 inches, stratified yellowish-brown (10YR 5/6) and gray, (10YR 5/1) mildly alkaline sand, gravel, and clay.

Included with this soil are small areas of Antioch, Rincon, and Soper soils. Also included are some small areas of nearly level soils.

This well-drained soil is moderately fertile. Available water holding capacity is about 8 to 10 inches. Permeability is moderately slow, runoff is slow, and the hazard of erosion is slight. The root zone is very deep.

This soil is used for irrigated grapes and for dryland grain and incidental pasture. Capability units IIe-1 (14) and IIIe-3 (15); pasture and range site 4.

Pleasanton gravelly loam, 5 to 9 percent slopes, eroded (PvC2).—This soil is similar to Pleasanton loam, 2 to 5 percent slopes, but it is more sloping and is gravelly throughout. It occurs in small to medium-sized areas along larger drainageways. In most places it is brown, but color ranges to grayish brown.

Available water holding capacity is about 7 to 9 inches. Runoff is medium, and the hazard of erosion is moderate.

This soil is used for dryland grain and pasture. Capability units IIIe-1 (14) and IIIe-3 (15); pasture and range site 4.

Reiff Series

The Reiff series consists of well-drained loamy soils formed in alluvium derived mainly from sedimentary uplands. These soils are nearly level to moderately sloping, and they are on flood plains and fans. The vegetation consists of annual grasses and forbs and scattered oaks. Elevations range from 120 to 1,500 feet above sea level. Annual rainfall is 12 to 16 inches. The average annual temperature is about 60° F., and the frost-free period is about 260 days. The main associated soils are the Clear Lake, Metz, Mocho, and Pacheco.

The surface layer is grayish-brown sandy loam 18 to 24 inches thick. The next layer is pale-brown to light brownish-gray sandy loam to loam that averages 30 to 36 inches in thickness. This layer is gravelly or is stratified with gravel and finer textured material. In some places the content of gravel throughout the profile is as much as 10 percent, by volume. Below this layer is a buried soil or stratified alluvium.

Reiff soils are used for irrigated fruits, nuts, alfalfa, field crops, and row crops and for dryland grain and incidental pasture.

Reiff sandy loam, 0 to 2 percent slopes (ReA).—This soil occurs on fans along the larger drainageways. Some areas are occasionally flooded.

Representative profile: 30 yards south of Fairview Road, 300 yards east of a seed company; in walnut orchard.

Ap—0 to 8 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine roots; common, very fine, interstitial pores; neutral; clear, smooth boundary.

A1—8 to 24 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine roots, few medium roots; common, very fine, tubular pores, few, fine, interstitial pores; mildly alkaline; clear, smooth boundary.

C1—24 to 42 inches, pale-brown (10YR 6/3) sandy loam, brown (10YR 4/3) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and nonplastic when wet; few medium and coarse roots; few, very fine, tubular pores; 1 to 2 percent very fine gravel; mildly alkaline, slightly effervescent; clear, smooth boundary.

IIC2—42 to 60 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few coarse roots; few, very fine and medium, tubular pores; moderately alkaline, strongly effervescent; clear, smooth boundary.

Included with this soil are small areas of Mocho and Metz soils and of soils that have a gravelly or loamy sand surface layer.

This soil is moderately fertile. Available water holding capacity is about 8 inches. Permeability is moderately rapid, runoff is very slow, and the hazard of erosion is slight to none. The root zone is very deep.

This soil is used for irrigated fruits and nuts, sugar beets, tomatoes, and other vegetables and alfalfa. Dryland crops include grain and incidental pasture. Capability units I-1 (14) and IIIc-1 (15).

Reiff sandy loam, 2 to 9 percent slopes (ReC).—This soil is similar to Reiff sandy loam, 0 to 2 percent slopes, but is more sloping. It occurs on small to medium-sized fans along the major drainageways. The areas closest to the streams are occasionally flooded. Slopes dominantly range from 3 to 6 percent. In some areas as much as 10 percent, by volume, of the profile is fine to medium gravel.

Included with this soil are a few very small areas of soils that have a gravelly or loamy sand surface layer and a few small areas of Metz and Mocho soils.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for irrigated fruits and nuts, sugar beets, vegetables, and alfalfa and for dryland grain, and incidental pasture. Capability units IIe-1 (14) and IIIe-1 (15).

Rincon Series

The Rincon series consists of well-drained soils that formed in alluvium derived from sandstone and shale. These soils have a loamy surface layer and a clayey subsoil. They occur on benches, terraces, or fans and are nearly level to strongly sloping. They are around the edge of Hollister Valley and along the flood plains and in the valleys bordering the larger drainageways. Vegetation consists of annual grasses and forbs and scattered oaks. Rincon soils are 200 to 1,500 feet above sea level. Annual rainfall ranges from 12 to 16 inches. The average annual temperature is about 60° F., and the frost-free period is about 260 days. The main associated soils are the Antioch, Cropley, Pleasanton, and Sorrento.

The surface layer is dark-gray to grayish-brown silty clay loam or loam 20 to 24 inches thick. The subsoil is brown clay 20 to 30 inches thick. The substratum is light yellowish-brown clay loam 20 to 40 inches thick. At depths of more than 60 inches, the underlying alluvium is calcareous sand, gravel, and clay in strata that extend to an undetermined depth. Some small areas are gravelly throughout the profile. A few areas along Lone Tree Road are gravelly in the surface layer and have a very gravelly substratum.

Rincon soils are used for irrigated apricots, prunes, grapes, walnuts, alfalfa, sugar beets, tomatoes, and other vegetables, and for dryland grain, and pasture.

Rincon silty clay loam, 0 to 2 percent slopes (RsA).—This nearly level soil occurs on broad terraces.

Representative profile: On Young Ranch, 600 yards east of house and 200 yards north of stream; at edge of young prune orchard.

Ap—0 to 12 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) when moist; moderate, fine, granular structure; hard when dry, firm when moist, sticky and plastic when wet; plentiful very fine and fine roots; common, very fine and fine, interstitial pores; mildly alkaline; gradual, smooth boundary.

A1—12 to 23 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; plentiful very fine and fine roots; common, very fine and fine, tubular pores; few, fine and medium, interstitial pores; mildly alkaline; gradual, smooth boundary.

B21t—23 to 33 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) when moist; moderate, medium, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; few very fine and fine roots; common, very fine and fine, tubular pores; few, thin, patchy clay films; few small slickensides; material from the A horizon in fine seams and on ped surfaces; mildly alkaline; gradual, smooth boundary.

B22t—33 to 45 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) when moist; strong, medium, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; few very fine and fine roots; common, very fine and fine, tubular pores; many fine and medium slickensides; thin, patchy clay films on ped faces and on pores; lime in seams and soft masses; moderately alkaline; slightly effervescent; gradual, smooth boundary.

Cca—45 to 80 inches, light yellowish-brown (10YR 6/4) clay loam, dark brown (10YR 4/3) when moist; strong, medium, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; common, very fine and fine, tubular pores; brittle and compact in place; lime in seams and soft masses; moderately alkaline; strongly effervescent; gradual, smooth boundary.

Included in mapping were small areas of Cropley, Antioch, and Pleasanton soils.

This soil is moderately fertile. The available water holding capacity is 8 to 10 inches. Permeability is slow, runoff is very slow, and the erosion hazard is slight to none. A few areas may be ponded for short periods during the winter. The rooting depth is very deep.

This soil is used for irrigated fruit and nut trees, irrigated alfalfa, grapes, and dryland grain and incidental pasture. Capability unit IIs-5 (14).

Rincon silty clay loam, 2 to 9 percent slopes (RsC).—This soil is similar to Rincon silty clay loam, 0 to 2 percent slopes, but is gently sloping to moderately sloping. It occurs in small to medium-sized areas that generally have slopes of 3 to 6 percent. In a few areas fine to medium gravel is in all parts of the profile, but it generally makes up less than 10 percent of the soil mass by volume. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for irrigated alfalfa, apricots, grapes, walnuts, and prunes, and for dryland grain and incidental pasture. Capability units IIe-5 (14) and IIIe-5 (15).

Rincon silty clay loam, 9 to 15 percent slopes, eroded (RsD2).—This soil is similar to Rincon silty clay loam, 0 to 2 percent slopes, but has a thinner profile and is strongly sloping, and is more eroded. Areas are small to moderate in size, and slopes generally range from 12 to 15 percent. In some areas fine to medium-sized gravel is in all parts of the profile.

Included in mapping were some small areas where there is less clay than normal in the subsoil and areas where the substratum is very firm. Also included were areas where erosion is only slight.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

The soil is used for dryland pasture and grain. Capability unit IIIe-5 (15); pasture and range site 4.

Rincon loam, 0 to 2 percent slopes (RnA).—This soil is similar to Rincon silty clay loam, 0 to 2 percent slopes, but has a loam surface layer. It is nearly level and occurs in small areas on large terraces near the Comstock-Las Viboras Road and in a few other small areas. In most places the subsoil and substratum are gravelly. In some areas the surface layer contains fine gravel that generally makes up less than 5 percent of the soil mass by volume. Available water holding capacity is about 8 inches.

This soil is used for irrigated alfalfa, apricots, grapes, walnuts, and prunes, and for dryland grain and incidental pasture. Capability unit IIs-5 (14).

Rincon loam, 2 to 9 percent slopes (RnC).—This soil is similar to Rincon silty clay loam, 0 to 2 percent slopes, but is gently sloping to moderately sloping and has a loam surface layer. It occurs on small to medium-sized fans, generally along the larger drainageways. In some places fine to medium-sized gravel is in the profile. Dominant slopes are 3 to 6 percent. Available water holding capacity is about 8 inches. Runoff is slow to medium, and the erosion hazard is slight to moderate.

This soil is used for irrigated apricots, grapes, walnuts, and prunes, and for dryland grain and incidental pasture. Capability units IIIe-1 (14) and IIIe-3 (15).

Rincon loam, 9 to 15 percent slopes, eroded (RnD2).—This soil is similar to Rincon silty clay loam, 0 to 2 percent slopes, but is slightly thinner, has a loam surface layer, and is moderately eroded. It occurs throughout the survey area generally on small to medium-sized fans where slopes range from 12 to 15 percent. In some areas fine and medium-sized gravel occurs throughout the profile and makes up as much as 10 percent of the profile by volume. Available water holding capacity is about 8 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to severe.

This soil is used mostly for dryland grain and pasture. Capability unit IVe-1 (15); pasture and range site 4.

Riverwash

Riverwash (Rw) consists of the coarse-textured materials—sands and gravels—that occur in the beds of the larger streams. The materials are generally covered by flowing water during the rainy season, which results in scouring and deposition. Many areas have little or no vegetation but some of the sandier, less gravelly areas are covered by grass, forbs, brush, willows, and cottonwoods. In general, these areas have little or no use for farming, though at times a few areas furnish limited grazing. A few areas on the larger streams are used for commercial production of sand and gravel. Capability unit VIIIw-4 (14).

Salinas Series

The Salinas series consists of well-drained, loamy soils that formed in alluvium derived from sandstone and shale. These nearly level to moderately sloping soils lie on flood plains and fans. The vegetation consists of annual grasses and forbs and a few scattered oaks. Elevations range from 150 to 2,000 feet above sea level. Annual rainfall is 12 to 14 inches. The average annual temperature is about 60° F., and the frost-free period is about 260 days. The main associated soils are the Hanford and Sorrento.

The surface layer is dark-gray to dark grayish-brown clay loam 20 to 26 inches thick. The next layer is brown to light yellowish-brown clay loam 24 to 36 inches thick. Below this is light yellowish-brown clay loam that extends to undetermined depths. In some areas these soils have gravel throughout the profile.

Salinas soils are used for irrigated grapes and other fruits, nuts, vegetables, and row crops, and for dryland grain and incidental pasture.

Salinas clay loam, 0 to 2 percent slopes (SaA).—This soil occurs on fans around San Juan Bautista and in Topo and Vallecitos Valleys.

Representative profile: 20 yards west of the New Idria Road, in Vallecitos Valley, on McDonald Ranch; 1 mile southeast of ranch house.

A11—0 to 8 inches, dark-gray (10YR 4/1) clay loam, black (10YR 2/1) when moist; moderate, fine, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; abundant very fine and fine roots; common, very fine and fine, tubular pores; neutral; clear, smooth boundary.

A12—8 to 25 inches, dark-gray (10YR 4/1) clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; abundant very fine and fine roots; common, very fine and fine, tubular pores, few, medium, interstitial pores; neutral; gradual, smooth boundary.

C1—25 to 33 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, sticky and plastic when wet; plentiful very fine and fine roots; common, very fine and fine, tubular pores; material from A horizon in seams and as films on ped surfaces; mildly alkaline, slightly effervescent; clear, smooth boundary.

C2ca—33 to 66 inches, light yellowish-brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; many, very fine and fine, tubular pores; many fine and medium seams of lime and many, small, soft masses of lime; moderately alkaline, violently effervescent; gradual, smooth boundary.

Included with this soil are some soils around San Juan Bautista that have a slightly thicker surface layer, less lime in the substratum and some alluvium derived from granitic rocks. Also included are small areas of Hanford and Sorrento soils and soils that have a loam surface layer.

This soil is moderately fertile. Available water holding capacity is about 10 to 12 inches. Permeability is moderately slow, runoff is very slow, and the hazard of erosion is slight to none.

This soil is used for irrigated grapes and other fruits, nuts, vegetables, row crops, and for dryfarmed grain and incidental pasture. Capability units I–1 (14) and IIIc–1 (15).

Salinas clay loam, 2 to 9 percent slopes (SaC).—This soil is similar to Salinas clay loam, 0 to 2 percent slopes, but it is more sloping. It generally occurs in small areas along the larger drainageways. Slopes are dominantly 3 to 6 percent. In some areas small amounts of fine to medium gravel occur throughout the profile, but they are not more than a few percent, by volume.

Included with this soil are some soils that have a loam surface layer.

Runoff is slow to medium. The hazard of erosion is slight to moderate.

This soil is used for dryland grain and incidental pasture. Capability units IIe–5 (14) and IIIe–5 (15).

San Benito Series

The San Benito series consists of well-drained loamy soils that are underlain by calcareous, interbedded sandstone and shale at a depth of 24 to 48 inches. These soils occupy mountainous uplands and are rolling to steep. The vegetation consists chiefly of annual grasses and forbs, but a few areas are covered with oaks or brush. Elevations range from 400 to 3,500 feet. Annual rainfall is 12 to 18 inches, average annual temperature is 60° to 62° F., and the frost-free period is about 260 days. The Linne and Gazos soils are the main associated soils.

The surface layer is dark grayish-brown clay loam 20 to 32 inches thick. The next layer is light yellowish-brown clay loam 8 to 24 inches thick. It is slightly to moderately effervescent. Texture throughout the profile ranges from clay loam to silty clay loam but is clay loam in most places. The parent rock, at a depth of 24 to 48 inches is soft, calcareous, interbedded shale and medium-grained sandstone.

San Benito soils are used for dryland grain, pasture, and range. A few small areas are irrigated and are used for fruit and nut trees.

San Benito clay loam, 15 to 30 percent slopes, eroded (SbE2).—This soil occurs on moderately steep rounded hills or on ridgetops.

Representative profile: One-half mile west of Willow Creek Road, 5 miles north of San Benito; central part of section 8, T. 15 S., R. 8 E.

A11—0 to 10 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, subangular blocky structure that breaks readily to moderate, fine, granular structure; very hard when dry, firm when moist, sticky and plastic when wet; abundant very fine roots; common, very fine, interstitial pores; neutral; clear, smooth boundary.

A12—10 to 28 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; plentiful very fine roots; few, very fine, interstitial and tubular pores; few, fine, pressure faces; neutral; gradual, smooth boundary.

C1ca—28 to 48 inches, light yellowish-brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; plentiful very fine roots; common, very fine and fine, tubular pores; lime is disseminated and occurs as coatings in pores and on some ped surfaces; moderately alkaline; gradual, smooth boundary.

C2—48 to 60 inches +, yellowish-brown (10YR 5/4), soft, calcareous sandy shale.

Included with this soil are small areas of Diablo, Gaviota, and Linne soils and outcrops of sandstone. Also included are soils that are shallow over bedrock.

This soil is moderately fertile. Available water holding capacity is 6 to 8 inches. Permeability is moderately slow, runoff is rapid, and the hazard of erosion is severe. The root zone is deep.

This soil is used for dryland pasture. Capability unit IVe-5 (15); pasture and range site 5.

San Benito clay loam, 9 to 15 percent slopes (SbD).—This soil is similar to San Benito clay loam, 15 to 30 percent slopes, eroded, but it has a thicker profile, is less sloping, and is not more than slightly eroded. This soil generally occurs on low hills and broad ridges.

Included with this soil are small areas of Diablo and Cropley soils along drainageways and in saddles.

Available water holding capacity is 8 to 10 inches. Runoff is medium, and the hazard of erosion is moderate. The root zone is deep.

This soil is used for dryland grain and pasture. A few small areas are used for irrigated fruits and nuts. Capability unit IIIe-5 (15); pasture and range site 5.

San Benito clay loam, 30 to 50 percent slopes, eroded (SbF2).—This soil is similar to San Benito clay loam, 15 to 30 percent slopes, eroded, but is more sloping. It is steep and occurs on side slopes in areas of moderately steep soils or on narrow, winding ridgetops. Slopes are dominantly between 45 and 50 percent. This soil is darker and somewhat deeper on north-facing slopes than in other areas.

Included with this soil are areas of brown, fine-textured soils, of shallow soils, and of rock outcrops.

On this soil runoff is rapid to very rapid. The hazard of erosion is severe to very severe.

This soil is used for dryland pasture. Capability unit VIe-5 (15); pasture and range site 5.

San Benito clay loam, 30 to 50 percent slopes, severely eroded (SbF3).—This soil is similar to San Benito clay loam, 15 to 30 percent slopes, eroded, but it is more eroded, is steeper, and is only 24 to 36 inches deep to weathered bedrock. It is steep and occurs along the larger drainageways, on partly slipped areas, or in areas of accelerated geologic erosion (fig. 11). Some areas are barren and actively eroding, others have a thin cover of grass or brush or are covered by moderately thick stands of oaks and brush.

Included with this soil are small to moderate areas of shallow soils, Sedimentary rock land, gullied areas, and Landslides. The gullied areas are sources of silt and debris.

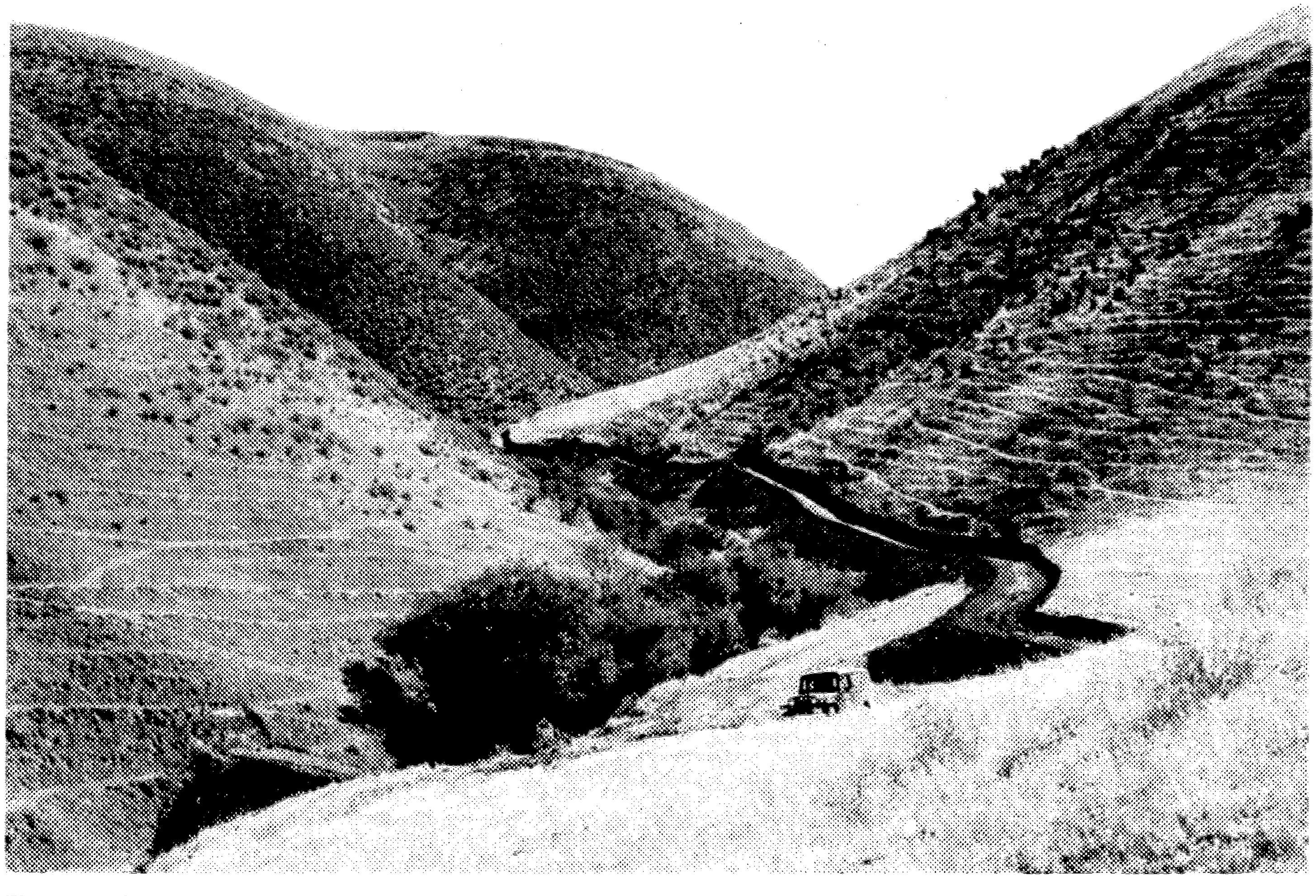

Figure 11.—San Benito clay loam, 30 to 50 percent slopes, severely eroded. Stock trails are very evident, and brush is intruding on overgrazed areas.

Available water holding capacity is 4 to 6 inches. Run off is rapid to very rapid and the hazard of erosion is very severe. This soil has low fertility.

This soil is used for range. Capability unit VIIe-5 (15); pasture and range site 5.

Sandy Alluvial Land

Sandy alluvial land (Sc) lies along the lower courses of Pescadero, Stone, and Chalone Creeks and along a few of the small drainageways flowing from Gabilan Range. Slopes generally range from 1 to 4 percent, but a few areas are more sloping. Many of the areas are flooded occasionally and are subject to removal and deposition of material, but a few areas are above flood level.

Included with this land type, generally in the narrower heads of the valleys of the creeks, are a few gravelly and stony soils.

Fertility is low on this land. Available water holding capacity is 4 to 6 inches.

This land is used for limited grazing. Capability unit VIIw-4 (14).

Santa Lucia Series

The Santa Lucia series consists of somewhat excessively drained very shaly, loamy soils that are underlain by moderately hard, light-colored shale. These soils are moderately steep to very steep and occupy uplands underlain by shale. The vegetation consists of annual grasses and forbs and thin to moderately thick stands of oaks, Digger pine, and brush. Elevations range from 1,200 to 2,000 feet above sea level. Annual rainfall is 12 to 16 inches. Average annual temperature is about 58° F., and the frost-free period is about 250 days. The main associated soils are the Pinnacles, Laniger, Sheridan, and Gazos.

The surface layer is gray to very dark gray shaly loam 18 to 30 inches thick. The darker colored soils generally occur on north-facing slopes under moderately thick stands of oaks. The profile becomes more shaly as depth increases. Depth to shale is generally 20 to 30 inches, but it ranges from 8 to 40 inches. The underlying shale is generally moderately hard, light gray and pale brown, and highly fractured. These soils are medium acid in most places, but they are slightly acid in some places.

Santa Lucia soils are used for dryland pasture and range and for watersheds, wildlife, and recreation.

Santa Lucia shaly loam, 30 to 50 percent slopes, eroded (SdF2).—This soil occupies narrow, rounded ridges. It is 18 to 40 inches deep over shale.

Representative profile: On hillside, 30 yards west of State Route 25, on ranch road, 400 yards north of Jef Schmidt's house.

A11—0 to 4 inches, gray (10YR 5/1) shaly loam, very dark gray (10YR 3/1) when moist; moderate, fine, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, very fine and fine, tubular pores, few, very fine and fine, interstitial pores; medium acid; clear, smooth boundary.

A12—4 to 22 inches, gray (10YR 5/1) very shaly loam, very dark gray (10YR 3/1) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, very fine and fine, tubular pores, common, fine and medium, interstitial pores; medium acid; gradual, smooth boundary.

R—22 inches, pale-brown and light-gray, weathered, highly fractured, moderately hard, acid shale.

Included with this soil are some small areas of Gazos, San Benito, Laniger, and Pinnacles soils, of soils that are shallow over shale, of soils that are mildly alkaline, and of rock outcrops. Also included are small areas of Santa Lucia soils that are moderately steep and are slightly deeper over bedrock. Other included areas are severely eroded.

This soil has low fertility. Available water holding capacity is about 2 to 4 inches, permeability is moderately rapid, runoff is rapid to very rapid, and the hazard of erosion is severe to very severe. The root zone is moderately deep.

This soil is used for dryland pasture, range, wildlife, watersheds, and recreation. Capability unit VIe-1 (15); pasture and range site 2.

Santa Lucia shaly loam, 30 to 75 percent slopes, severely eroded (SdG3).—This soil is similar to Santa Lucia shaly loam, 30 to 50 percent slopes, eroded, but is more sloping, is severely eroded, and is only 8 to 18 inches deep over bedrock. It is covered with brush. Slopes are dominantly 55 to 60 percent.

Included with this soil are areas of shale rock outcrops and small areas of Laniger soils.

This soil has very low fertility. Available water holding capacity is 1 to 2 inches. Runoff is rapid to very rapid, and the hazard of erosion is very severe. The root zone is shallow.

This soil is used for watersheds, wildlife, and recreation and for range. Capability unit VIIe-1 (15); pasture and range site 2.

Sedimentary Rock Land

Sedimentary rock land (SeG) consists of outcrops of moderately hard sandstone and shale and areas of very thin soils. The rock outcrops generally make up 35 to 90 percent of the surface. The plant cover is sparse to moderately thick and consists of low brush, small areas of sparse grasses, and some scattered oaks and Digger pine. Drainage is excessive, and a moderate to large amount of silt is washed away.

Included with this land are small areas of shallow soils and surrounding soils that have a grass cover in some places.

This land is used for watersheds, wildlife, and recreation. Capability unit VIIIs-1 (15).

Shedd Series

The Shedd series consists of well-drained to somewhat excessively drained loamy soils that are underlain by soft, calcareous sandstone and shale generally at a depth of 20 to 40 inches. These soils are on uplands and are strongly sloping to steep. The vegetation consists of annual grasses and forbs, a few scattered oaks, and areas of low brush on the more eroded slopes. Elevations range from 1,000 to 2,000 feet above sea level. Annual rainfall is 12 to 14 inches. Average annual temperature is about

60° F., and the frost-free period is about 260 days. The main associated soils are the Diablo, Linne, Lodo, and Santa Lucia.

The surface layer is light-gray or gray loam 12 to 20 inches thick. The next layer is light-gray or gray stony loam 8 to 28 inches thick. The underlying material is fine- to medium-grained, interbedded sandstone and shale that is coated with lime. Depth to sandstone and shale is dominantly between 20 and 40 inches, but is 8 to 20 inches in the severely eroded, steep soils.

Shedd soils are used for dryland grain and pasture, range, watersheds, and wildlife.

Shedd loam, 30 to 50 percent slopes, eroded (ShF2).—This soil is steep and occurs on uplands that have narrow, winding ridgetops.

Representative profile: On hillside, 30 yards to the east of King City Road, 3 miles southwest of Bitterwater store.

A11—0 to 3 inches, light-gray (10YR 6/1) loam, dark grayish brown (2.5Y 4/2) when moist; moderate, fine, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, very fine and fine, tubular pores, common, very fine and fine, interstitial pores; moderately alkaline, strongly effervescent; abrupt, smooth boundary.

A12—3 to 12 inches, light-gray (10YR 6/1) loam, dark grayish brown (2.5Y 4/2) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; common, fine and medium, tubular pores, common, fine and medium, interstitial pores; moderately alkaline, strongly effervescent; clear, smooth boundary.

A13—12 to 20 inches, light-gray (10YR 6/1) loam, dark grayish brown (2.5Y 4/2) when moist; weak, medium, subangular blocky structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; common, very fine and fine, tubular pores; moderately alkaline, violently effervescent; gradual, smooth boundary.

C1—20 to 32 inches, light-gray (10YR 6/1) stony loam, dark grayish brown (2.5Y 4/2) when moist; weak, medium, subangular blocky structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; common, very fine and fine, tubular pores; moderately alkaline, violently effervescent; gradual, wavy boundary.

C2—32 to 60 inches, very light gray (10YR 7/2), calcareous, fine-grained, soft sandstone; coated with lime.

Included with this soil are some areas of Linne and Santa Lucia soils and areas of rock outcrops. Also included are severely eroded areas.

This somewhat excessively drained soil has low fertility. Available water holding capacity is about 3 to 8 inches. Permeability is moderate, runoff is rapid to very rapid, and the hazard of erosion is severe to very severe. The root zone is moderately deep.

This soil is used for range, watershed, and wildlife. Capability unit VIIe-1 (15); pasture and range site 7.

Shedd loam, 9 to 15 percent slopes (ShD).—This soil is similar to Shedd loam, 30 to 50 percent slopes, eroded, but it is less sloping, is only slightly eroded, and is somewhat deeper and more grayish. It occurs on broad ridges or on low rounded hills.

Included with this soil are small areas of Linne soils on north-facing slopes, around drainageways, and in saddles.

This well-drained soil has available water holding capacity of 5 to 6 inches. Runoff is medium, and the hazard of erosion is moderate.

This soil is used for dryland grain and pasture. Capability unit IVe-1 (15); pasture and range site 7.

Shedd loam, 15 to 30 percent slopes, eroded (ShE2).—This soil is similar to Shedd loam, 30 to 50 percent slopes, eroded, but it is less sloping. It occurs on broad ridgetops or side slopes. The underlying material is mostly calcareous sandstone and shale. The cover is generally grass, but low brush grows in some areas.

Included with this soil are small areas that are shallow over bedrock and areas that are severely eroded.

This soil is well drained. Runoff is rapid, and the hazard of erosion is severe. The root zone is moderately deep.

This soil is used mostly for dryland pasture and range. A few small tracts are used for dryland grain. Capability unit VIe-1 (15); pasture and range site 7.

Shedd loam, 30 to 50 percent slopes, severely eroded (ShF3).—This soil is similar to Shedd loam, 30 to 50 percent slopes, eroded, but it is not as deep and is severely eroded. This soil is shallow; because it has been severely eroded, average depth to sandstone and shale is 8 to 20 inches. Slopes are dominantly 45 to 50 percent.

Included with this soil are some soils that have slopes of 55 to 60 percent, areas of rock outcrops, areas of very thin soils, and some small areas of Santa Lucia and Linne soils. Also included are some moderately steep Santa Lucia soils that are moderately eroded.

This soil has very low fertility. Available water holding capacity is 1 to 3 inches. Runoff is rapid to very rapid, and the hazard of erosion is very severe. The root zone is shallow.

This soil is used for range, watersheds, and wildlife. Capability unit VIIe-1 (15); pasture and range site 7.

Sheridan Series

The Sheridan series consists of well-drained to somewhat excessively drained loamy soils that are underlain by weathered granite. These soils are strongly sloping to very steep and lie on mountainous uplands. They occur generally in an area west of Cienega Road and northwest of the Lime Kiln Road. The vegetation ranges from annual grasses and forbs to areas of Digger and Coulter pines, oaks, and brush. Elevations range from 1,200 to 3,800 feet above sea level. Annual rainfall is 20 to 25 inches. Average annual temperature is about 56° F., and the frost-free period is about 250 days. The main associated soils are the Auberry and Cieneba.

The surface layer is 14 to 36 inches thick. It is dark grayish-brown or dark-brown to brown coarse sandy loam. The next layer is dark grayish-brown coarse sandy loam 4 to 24 inches thick. The underlying granite is generally deeply weathered, but there are areas underlain by unweathered granite or by medium- to fine-grained igneous rock. In small areas the underlying rock is limestone and marble over granite. Depth to the underlying rock generally ranges from 18 to more than 60 inches but is between 30 and 55 inches in most places.

Sheridan soils are used for dryland pasture and range and for watersheds, wildlife, and recreation.

Sheridan coarse sandy loam, 15 to 30 percent slopes (SkE).—This moderately steep soil occurs on rounded ridgetops in areas of steeper soils. Slopes average about 25 percent.

Representative profile: On 101 Ranch, by ranch road, toward ridgetop, 3 miles west of ranchhouse.

A11—0 to 7 inches, dark grayish-brown (10YR 4/2) coarse sandy loam, very dark brown (10YR 2/2) when moist; moderate, fine, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; many, very fine and fine, interstitial pores; slightly acid; clear, smooth boundary.

A12—7 to 16 inches, dark grayish-brown (10YR 4/2) coarse sandy loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; many, very fine, fine, and medium, interstitial pores; neutral; gradual, smooth boundary.

A13—16 to 28 inches, dark grayish-brown (10YR 4/2) coarse sandy loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; few, very fine and medium, tubular pores, common, very fine, fine, and medium, interstitial pores; slightly acid; gradual, smooth boundary.

C1—28 to 38 inches, dark grayish-brown (10YR 4/2) coarse sandy loam, very dark brown (10YR 2/2) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; common, fine and medium, tubular pores, common, medium, interstitial pores; slightly acid; gradual, smooth boundary.

C2—38 to 52 inches, brown (10YR 4/3) coarse sandy loam, dark brown (10YR 3/3) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; common, very fine, fine, and medium, tubular pores; medium acid; gradual, smooth boundary.

C3—52 inches, yellowish-brown (10YR 5/6), strongly weathered, highly fractured granite with relict rock structure.

Included with this soil are areas of Auberry and Cieneba soils that intergrade to Sheridan soils at lower elevations. Also included are some areas of rock outcrops, small areas of soils that are underlain by limestone or marble, and areas of moderately eroded soils.

This well-drained soil has low to moderate fertility. Available water holding capacity is 5 to 7 inches. Permeability is moderately rapid, runoff is medium to rapid, and the hazard of erosion is moderate to severe. The root zone is deep.

This soil is used for dryland pasture and for wildlife, watersheds, and recreation. Capability unit VIe–4 (15); pasture and range site 3.

Sheridan coarse sandy loam, 9 to 15 percent slopes (SkD).—This soil is similar to Sheridan coarse sandy loam, 15 to 30 percent slopes, but it is less sloping. It occurs on toe slopes or in areas around the heads of larger drainageways in the Gabilan Range. Slopes dominantly range from 9 to 12 percent. The depth to weathered granite averages 36 to 48 inches but is more than 60 inches in some places.

Included with this soil are areas of sandy loam.

On this soil runoff is medium, and the hazard of erosion is moderate. The root zone is deep.

This soil is used for dryland pasture. Capability unit IVe–1 (15); pasture and range site 3.

Sheridan coarse sandy loam, 15 to 30 percent slopes, eroded (SkE2).—This soil is similar to Sheridan coarse sandy loam, 15 to 30 percent slopes, but it is slightly shallower over bedrock and is more eroded. Depth to bedrock ranges from 24 to 36 inches. It is moderately steep and occurs on rounded hills or on rounded ridgetops in areas of steeper soils. Dominant slopes are 20 to 25 percent. Some areas have a cover of grass or grass, oaks, and Digger pine, but large areas are covered with brush.

This soil is low in fertility. Available water holding capacity is 3 to 5 inches. The root zone is 24 to 36 inches. Runoff is rapid, and the hazard of erosion is severe.

This soil is used for pasture and for watersheds, wildlife, and recreation. Capability unit VIe–4 (15); pasture and range site 3.

Sheridan coarse sandy loam, 30 to 75 percent slopes, eroded (SkG2).—This soil is similar to Sheridan coarse sandy loam, 15 to 30 percent slopes, but it is shallower to bedrock, is more sloping, and is moderately eroded. It is steep to very steep and occurs on rounded ridgetops or in mountainous areas. Slopes dominantly range from 45 to 60 percent. This soil is generally dark-brown or grayish-brown coarse sandy loam to loam. Depth to bedrock averages from 18 to 30 inches. The plant cover is generally grass and thin to moderately thick stands of oaks, Digger pine, and Coulter pine. Some eroded areas are in brush.

Included with this soil are areas as fine textured as loam. Also included are severely eroded areas, areas of thin soils, rock outcrops, and a few small areas of Auberry soils.

This somewhat excessively drained soil has low fertility. Available water holding capacity is 3 to 5 inches. Runoff is rapid to very rapid, and the hazard of erosion is severe to very severe.

This soil is used for range and for watersheds, wildlife, and recreation. Capability unit VIIe–4 (15); pasture and range site 3.

Sheridan coarse sandy loam, 30 to 75 percent slopes, severely eroded (SkG3).—This soil is similar to Sheridan coarse sandy loam, 15 to 30 percent slopes, but it is shallower over bedrock, is steeper, and is severely eroded. It is steep to very steep and occurs on rounded hills or in mountainous areas. Slopes are dominantly between 45 and 60 percent. Average depth to weathered granite is 18 to 24 inches. The plant cover is generally brush or brush and thin stands of grass, but some areas are covered by grass and some by oaks and pines.

Included with this soil are areas of sandy loam. Also included are outcrops of granite or fine-grained igneous rocks that generally make up less than 10 percent of the mapped area.

This somewhat excessively drained soil has low fertility. Available water holding capacity is 2 to 4 inches. Runoff is rapid to very rapid, and the hazard of erosion is very severe.

This soil is used for range and for watersheds, wildlife, and recreation. Capability unit VIIe–4 (15); pasture and range site 3.

Soper Series

The Soper series consists of well-drained loamy soils that are underlain by stratified, semiconsolidated sand and gravel at a depth of 30 to 48 inches. These soils lie on uplands and are strongly sloping to steep. The vegetation is chiefly annual grasses and forbs, scattered stands of oaks, and some brush on the more eroded slopes. Elevations range from 200 to 2,000 feet above sea level. Annual rainfall is 12 to 20 inches. Average annual temperature is about 60° F., and the frost-free period is about 260 days. The main associated soils are the San Benito, Los Gatos, Diablo, Pleasanton, and Vallecitos.

The surface layer is dark grayish-brown to brown sandy loam and gravelly loam about 16 to 20 inches thick. The subsoil is brown sandy clay loam that is 14 to 28 inches thick. The substratum is stratified, semiconsolidated sand and gravel. It ranges from slightly acid to mildly alkaline and in places is slightly calcareous in the lower part.

The Soper soils are used mostly for dryland pasture and range, but a few small areas are used for irrigated fruits and nuts and for dryland wine grapes, apricots, and grain.

Soper sandy loam, 30 to 50 percent slopes, eroded (SmF2).—This soil occurs on side slopes. Slopes are generally between 45 and 50 percent.

Representative profile: On hillside to north of School Road, 1 mile north of Anzar Road and 1 mile west of U.S. Highway No. 101.

A11—0 to 7 inches, dark grayish-brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) when moist; moderate, fine, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, very fine and fine, interstitial pores; medium acid; clear, smooth boundary.

A12—7 to 16 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; common, very fine, fine, and medium, interstitial pores; slightly acid; gradual, smooth boundary.

B2t—16 to 30 inches, brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) when moist; moderate, medium, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few very fine and fine roots; few, very fine and fine, tubular pores; thin patchy clay films on ped surfaces and thin continuous clay films in larger pores; seams of material from the A horizon in cracks and larger pores; common stains of material from A horizon on ped surfaces; slightly acid; gradual, smooth, boundary.

IIC1—30 to 42 inches, pale-brown (10YR 6/3) loamy sand, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; few very fine and fine roots; slightly acid (pH 6.5); diffuse, smooth boundary.

IIIC2—42 to 84 inches, stratified, slightly acid (pH 6.5), yellowish-brown (10YR 6/4) and gray, (10YR 5/1) semiconsolidated sand and fine gravel.

Included with this soil are small areas of Pleasanton soils and of severely eroded Soper soils.

This soil has low fertility. Available water holding capacity is 5 to 7 inches. Permeability is moderately slow, runoff is rapid to very rapid, and the hazard of erosion is severe to very severe. The root zone is moderately deep to deep to the semiconsolidated substratum.

This soil is used for range. Capability unit VIIe-1 (15); pasture and range site 3.

Soper sandy loam, 9 to 15 percent slopes (SmD).—This soil is similar to Soper sandy loam, 30 to 50 percent slopes, eroded, but is slightly deeper to semiconsolidated material, is less sloping, and is only slightly eroded. It occurs in small areas that slope into drainageways. Slopes dominantly range from 12 to 15 percent. Average depth to semiconsolidated alluvium is 48 inches.

This soil is moderately fertile. Available water holding capacity is about 7 inches. Runoff is medium, and the hazard of erosion is moderate. The root zone is deep.

This soil is used for dryland grain and pasture. Capability unit IVe-1 (15); pasture and range site 3.

Soper sandy loam, 15 to 30 percent slopes, eroded (SmE2).—This soil is similar to Soper sandy loam, 30 to 50 percent slopes, eroded, but it is less sloping. It occurs on broad, rounded ridgetops and on rounded hills. Slopes dominantly range from 20 to 25 percent.

Included with this soil are a few areas of soil that have a grayish-brown surface layer and a few areas that have a loam surface layer. Also included are a few severely eroded areas.

On this soil runoff is rapid and the hazard of erosion is severe. The root zone is moderately deep.

This soil is used for dryland grain and pasture. Capability unit VIe-1 (15); pasture and range site 3.

Soper gravelly loam, 9 to 15 percent slopes (SlD).—This soil is similar to Soper sandy loam, 30 to 50 percent slopes, eroded, but it is less sloping, and has a gravelly loam surface texture. Also, its substratum is gravelly or very gravelly. The surface layer is dark grayish brown or grayish brown. It occurs with Pleasanton soils along the larger drainageways or on benches that have slopes of 9 to 12 percent.

Included with this soil are a few small areas of nongravelly soils and a few small areas of Pleasanton soils.

This soil is moderately fertile. Available water holding capacity is about 6 inches. Runoff is medium, and the hazard of erosion is moderate.

This soil is used for dryland grain and pasture. Capability unit IVe-1 (15); pasture and range site 3.

Soper gravelly loam, 15 to 30 percent slopes, eroded (SlE2).—This moderately eroded soil is similar to Soper sandy loam, 30 to 50 percent slopes, eroded, but it is gravelly and less sloping. It is generally dark grayish brown or grayish brown. This soil generally occurs along major drainageways where slopes are 20 to 25 percent.

Included with this soil are soils that have less clay in the subsoil and that are brown in color. Also included are slightly eroded and severely eroded areas.

This soil is moderately fertile. Available water holding capacity is 5 to 7 inches. Runoff is rapid, and the hazard of erosion is severe.

This soil is used for dryland grain and pasture. Capability unit VIe-1 (15); pasture and range site 3.

Soper gravelly loam, 30 to 50 percent slopes, eroded (SlF2).—This soil is similar to Soper sandy loam, 30 to 50 percent slopes, eroded, but it is gravelly throughout and has a dark grayish-brown gravelly loam surface layer.

It occurs along major drainageways and slopes are dominantly 35 to 45 percent. Available water holding capacity is about 5 to 7 inches.

Included with this soil are areas of brown soils that have a gravelly sandy loam surface layer and that have less clay in the subsoil. Also included are a few severely eroded areas, a few nongravelly areas, and a few small Landslides.

This soil is used for range. Capability unit VIIe-1 (15); pasture and range site 3.

Sorrento Series

The Sorrento series consists of well-drained, loamy soils that formed in alluvium derived from calcareous sandstone and shale. These soils are nearly level to moderately sloping and are on flood plains and fans. The vegetation consists of annual grasses and forbs and a few scattered oaks. Elevations range from 120 to 1,500 feet above sea level. Annual rainfall is 12 to 16 inches. Average annual temperature is about 60° F., and the frost-free period is about 260 days. The main associated soils are the Mocho, Metz, Yolo, Clear Lake, and Pacheco.

The surface layer is grayish-brown silt loam, gravelly loam, or silty clay loam 16 to 24 inches thick. This layer ranges from brown to grayish brown in color. The next layer is light brownish-gray silt loam, gravelly loam, or silty clay loam 16 to 24 inches in thickness. This layer is underlain by a similar layer that in places contains stratified sand and gravel or clay loam. It extends to a depth of more than 5 feet.

The Sorrento soils are used for irrigated apples, pears, apricots, grapes, walnuts, prunes, sugar beets, tomatoes, beans, lettuce, other vegetables, and alfalfa and for dryland grain and incidental pasture.

Sorrento silt loam, 0 to 2 percent slopes (SnA).—This soil occurs along drainageways on valley floors.

Representative profile: Gomes Ranch, 10 yards east of Flint Road, 75 yards north of State Route 156.

Ap—0 to 12 inches, grayish-brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2) when moist; moderate, fine, granular structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine roots; common, very fine, interstitial pores; mildly alkaline; clear, smooth boundary.

A1—12 to 18 inches, grayish-brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; common, very fine and fine, tubular pores; moderately alkaline; clear, smooth boundary.

C1—18 to 34 inches, light brownish-gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine roots; many, very fine, fine, and medium, tubular pores; moderately alkaline, slightly effervescent; gradual, smooth boundary.

C2—34 to 78 inches, light brownish-gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine roots; many, very fine and fine, tubular pores; few thin strata of very fine sand; moderately alkaline, strongly effervescent; clear, smooth boundary.

Included with this soil are some small areas of Mocho, Metz, and Yolo soils and some areas of a soil that has a clay surface layer.

This fertile soil has available water holding capacity of 10 to 12 inches. Permeability is moderate, runoff is very slow, and the hazard of erosion is slight to none. The root zone is very deep.

This soil is used for irrigated fruits, nuts, grapes, sugar beets, tomatoes, vegetables, and alfalfa and for dryland grain and incidental pasture (fig. 12). Capability units I-1 (14) and IIIc-1 (15).

Sorrento silt loam, 2 to 9 percent slopes (SnC).—This soil is similar to Sorrento silt loam, 0 to 2 percent slopes, but is more sloping. It occurs in small to medium-size areas along the larger drainageways. Slopes dominantly range from 3 to 5 percent. In places this soil is subject to occasional flooding. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for irrigated fruits and nuts, grapes, sugar beets, alfalfa, and vegetables and for dryland grain and incidental pasture. Capability units IIe-1 (14) and IIIe-1 (15).

Sorrento gravelly loam, 0 to 5 percent slopes (SoB).—This soil is similar to Sorrento silt loam, 0 to 2 percent slopes, but its texture is gravelly loam throughout the profile. It occurs along the larger drainageways on valley floors at places where drainageways come together, or it is along bends where floodwaters have swept over the bottom lands. Slopes are dominantly 1 to 3 percent. This soil is grayish-brown gravelly loam. Fine to medium gravel makes up more than 15 percent of the profile. The substratum is very gravelly in places.

Included with this soil are some small areas of Metz and Mocho soils. Also included are areas of clay loam or light clay loam.

Available water holding capacity is about 7 to 9 inches. Runoff is very slow to slow, and the hazard of erosion is none to slight.

This soil is used for irrigated fruits and nuts, grapes, and alfalfa and for dryland grain and incidental pasture. Capability unit IIs-4 (14).

Sorrento silty clay loam, 0 to 2 percent slopes (SrA).—This soil is similar to Sorrento silt loam, 0 to 2 percent slopes, but it is silty clay loam throughout the profile. It occurs on flood plains and valley floors in the larger valleys and along the larger drainageways. In color, this soil ranges from grayish brown to dark grayish brown. The substratum is stratified and in places ranges from light clay loam to loamy sand. In a few areas 10 percent of the solum, by volume, is fine and medium gravel.

Included with this soil are a few small areas of loam and silt loam and a few small areas of Pacheco and Clear Lake soils.

Available water holding capacity is about 10 to 12 inches. Permeability is moderately slow.

This soil is used for irrigated fruits and nuts, grapes, sugar beets, tomatoes, vegetables, and alfalfa and for dryland grain and incidental pasture. Capability units I-1 (14) and IIIc-1 (15).

Sorrento silty clay loam, 2 to 9 percent slopes (SrC).—This soil is similar to Sorrento silt loam, 0 to 2 percent slopes, but it is more sloping and is silty clay loam

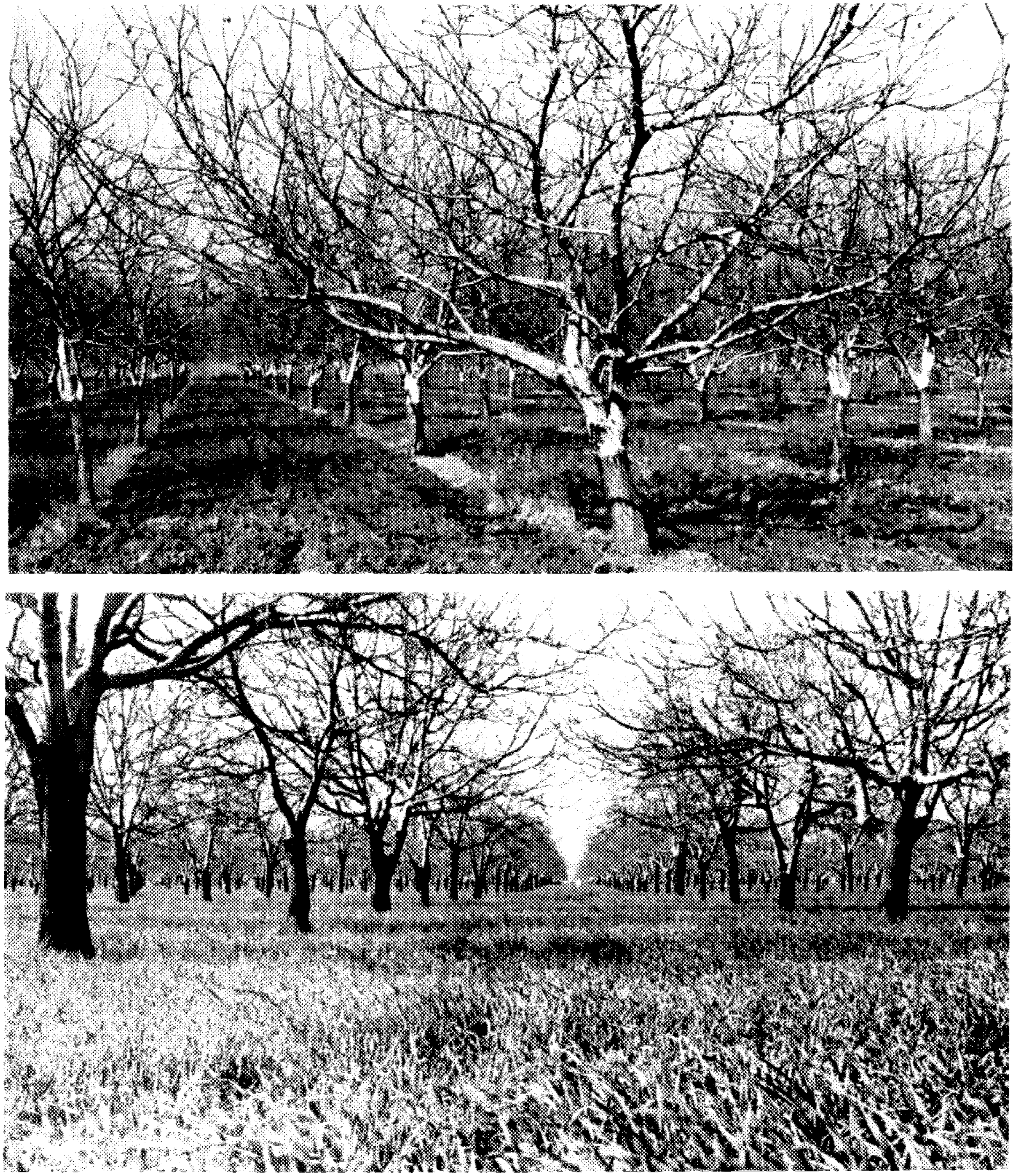

Figure 12.—Sorrento silt loam, 0 to 2 percent slopes. *Top,* young, healthy walnut trees. *Bottom,* mature walnut trees. The cover crop is barley.

throughout the profile. It occurs along the larger drainageways. Slopes are dominantly 3 to 6 percent. In some areas this soil contains a small amount of fine to medium gravel. Occasional flooding is a hazard in the lower positions along drainageways.

Permeability is moderately slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for irrigated fruits, nuts, grapes, and alfalfa and for dryland grain and incidental pasture. Capability units IIe-5 (14) and IIIe-5 (15).

Sween Series

The Sween series consists of well-drained clayey soils that are underlain by fine-grained, basic igneous rocks at a depth of 20 to 50 inches. In places these soils are stony or very stony or rocks crop out. These soils are on uplands and are moderately steep to steep. The vegetation consists of annual grasses and forbs and scattered oaks. Elevations range from 200 to 2,500 feet above sea level. Annual rainfall is 14 to 20 inches. Average annual temperature is about 62° F., and the frost-free period is about 250 days. The main associated soils are the San Benito, Los Gatos, Cibo, and Henneke.

The surface layer is gray clay loam, stony clay loam, or very stony clay loam 8 to 20 inches thick. The subsoil is light brownish-gray to pale-brown clay 8 to 18 inches thick. The substratum is light yellowish-brown coarse sandy clay 4 to 12 inches thick. It is underlain by yellowish-brown and gray, weathered, basic igneous rock. Depth to bedrock ranges from 20 to 50 inches but is between 24 and 36 inches in most places. In places bedrock crops out.

Sween soils are used for dryland pasture and range.

Sween rocky clay loam, 15 to 30 percent slopes, eroded (SsE2).—This soil occurs on broad rounded ridges and moderately steep uplands. Outcrops of bedrock make up 2 to 10 percent of this soil.

Representative profile: On U.S. Highway No. 101, one-half mile northeast of its junction with State Route 156, 100 yards northwest of highway.

A11—0 to 4 inches, gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) when moist; moderate, fine, granular structure; hard when dry, friable when moist, sticky and plastic when wet; abundant very fine and fine roots; common, very fine and fine, interstitial pores; medium acid; clear, smooth boundary.

A12—4 to 13 inches, gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; abundant very fine and fine roots; many, very fine and common, fine, tubular pores; slightly acid; clear, smooth boundary.

B21t—13 to 19 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) when moist; strong, medium, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; plentiful very fine and fine roots; common, very fine and fine, tubular pores; thin continuous clay films on ped surfaces and in pores; many fine and medium slickensides; neutral; gradual, smooth boundary.

B22t—19 to 27 inches, pale-brown (10YR 6/3) clay, brown (10YR 4/3) when moist; strong, medium, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; plentiful very fine roots; common, very fine, tubular pores; thin continuous clay films on ped surfaces; mildly alkaline; gradual, smooth boundary.

C—27 to 32 inches, light yellowish-brown (10YR 6/4) coarse sandy loam, dark yellowish brown (10YR 4/4) when moist; weak, medium, subangular blocky structure; very hard when dry, very firm when moist, sticky and plastic when wet; few very fine roots; few, very fine, tubular pores; mildly alkaline; gradual, irregular boundary.

R—32 inches, yellowish-brown (10YR 5/4) and gray (10YR 5/1), weathered, basic igneous rock.

Included with this soil are some small areas of Cibo soils and some soils that have a subsoil only 2 to 10 inches thick over bedrock. Also included are a few areas that are severely eroded.

This soil has moderate to low fertility; the calcium-magnesium ratio is low. Available water holding capacity is 4 to 6 inches. Permeability is slow, runoff is rapid to very rapid, and the hazard of erosion is severe to very severe. The root zone is moderately deep.

This soil is used for dryland pasture. Capability unit VIs-5 (15); pasture and range site 5.

Sween rocky clay loam, 30 to 50 percent slopes, eroded (SsF2).—This soil is similar to Sween rocky clay loam, 15 to 30 percent slopes, eroded, but is shallower to bedrock and is more sloping. It occurs on side slopes in the hills to the west of San Juan Bautista. Slopes are dominantly 35 to 40 percent. The cover is mostly grass, but some north-facing slopes have thin to moderately thick stands of oaks.

This soil has moderate to low fertility; the calcium-magnesium ratio is low. Available water holding capacity is 3 to 5 inches. The root zone extends to a depth of 24 to 30 inches.

This soil is used for dryland pasture. Capability unit VIs-5 (15); pasture and range site 5.

Sween stony clay loam, 15 to 30 percent slopes, eroded (StE2).—This soil has rounded pebbles and stones on the surface and in the profile. It is on ridgetops and in moderately steep areas along Lone Tree Road. Slopes are dominantly 20 to 25 percent. A few areas of rock outcrops are included.

This soil is moderately fertile. Available water holding capacity is 3 to 6 inches. The root zone is moderately deep. Runoff is rapid, and the hazard of erosion is severe.

This soil is used for dryland pasture. Capability unit VIs-5 (15); pasture and range site 5.

Sween very stony clay loam, 15 to 50 percent slopes, eroded (SwF2).—This soil is similar to Sween stony clay loam, 15 to 30 percent slopes, eroded, but it is very stony rather than stony, is shallower to bedrock, and is more sloping. Bedrock is at a depth of 20 to 30 inches. This soil occurs along Lone Tree Road where slopes are dominantly 45 to 50 percent.

Included with this soil are small areas of rock outcrops, small areas of severely eroded soils and shallow soils, and some areas of nonstony soils. Also included are areas of soils that have a surface layer ranging from loam to clay loam.

This soil has low fertility. Available water holding capacity is 2 to 5 inches. Runoff is rapid to very rapid, and the hazard of erosion is severe to very severe.

This soil is used for range. Capability unit VIIs-1 (15); pasture and range site 5.

Terrace Escarpments

Terrace escarpments (TeF) consists of even fronts of terraces and long narrow streambanks that have slopes of 20 to 50 percent. These areas range from gravelly loam to clay loam in texture. They are generally slightly to moderately eroded but are severely eroded in some areas. Most areas are covered by annual grasses and forbs and scattered oaks, but severely eroded areas support little or no vegetation.

Included with this mapping unit are nearly vertical streambanks and small areas that have slopes of as much as 75 percent. Also included are some areas where the streambanks slough into streams.

Terrace escarpments have low to moderate fertility. Runoff is rapid to very rapid, and the hazard of erosion is severe to very severe.

This land is used for pasture. Capability unit VIe–1 (15); pasture and range site 4.

Vallecitos Series

The Vallecitos series consists of well-drained loamy soils that are underlain by metamorphosed sandstone and shale. These soils have a loamy surface layer and a clayey subsoil. They are strongly sloping to steep and lie on mountainous uplands. The vegetation consists of annual grasses and forbs and some scattered oaks, Digger pine, and brush. Elevations range from 1,000 to 3,800 feet above sea level. Annual rainfall is 14 to 20 inches. Average annual temperature is about 60° F., and the frost-free period is about 240 days. The main associated soils are the Climara, Gaviota, and Montara.

The surface layer is brown loam 6 to 10 inches thick. The subsoil is reddish-brown to yellowish-red gravelly clay 6 to 26 inches thick. The underlying bedrock is interbedded, metamorphosed sandstone and shale. Depth to bedrock ranges from 12 to 36 inches.

Vallecitos soils are used for dryland pasture and for range, watersheds, wildlife, and recreation.

Vallecitos loam, 30 to 50 percent slopes, eroded (VaF2).—This soil is steep and occurs on side slopes or in areas that have rounded ridgetops.

Representative profile: In NE¼SW¼ section 26, T. 11 S., R. 3 E., about 20 yards up the hillside north of ranch road, one-half mile north of ranch house, 2 miles past the end of Comstock Road.

A—0 to 8 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant very fine roots; many, very fine, and, few, medium, tubular pores; slightly acid; clear, smooth boundary.

B21t—8 to 14 inches, reddish-brown (5YR 4/3) gravelly clay, dark reddish brown (5YR 3/3) when moist; moderate, medium, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; many, very fine, interstitial pores, few, medium, tubular pores; moderately thick continuous clay films lining pores and on ped surfaces; slightly acid; clear, smooth boundary.

B22t—14 to 18 inches, yellowish-red (5YR 5/6) gravelly clay, yellowish red (5YR 4/6) when moist; moderate, medium, subangular blocky structure; very hard when dry, firm when moist, plastic and sticky when wet; many, very fine, interstitial and tubular pores; moderately thick continuous clay films lining pores and on ped surfaces; slightly acid; abrupt, broken boundary.

R—18 inches, metamorphosed, yellowish-brown (10YR 5/6) fine-grained sandstone; clay films along cleavage planes.

Included with this soil are common outcrops of metamorphosed and ultrabasic rocks and areas of Climara and Montara soils. Also included are small areas of Gaviota soils, and a few small severely eroded areas that have a clay surface layer. Generally, the soils are darker and deeper on the north-facing slopes and have more trees and brush in the cover.

This soil has low fertility. Available water holding capacity is 2 to 5 inches. Permeability is slow, runoff is rapid to very rapid, and the hazard of erosion is severe to very severe. The root zone is shallow to moderately deep.

This soil is used for range and for watersheds, wildlife, and recreation. Capability unit VIIe–1 (15); pasture and range site 6.

Vallecitos loam, 9 to 15 percent slopes (VaD).—This soil is similar to Vallecitos loam, 30 to 50 percent slopes, eroded, but it has a thicker profile, is less sloping, and is only slightly eroded. It occurs on toe slopes in areas of steeper soils. Slopes dominantly range from 12 to 15 percent. The surface layer ranges in color from brown to dark brown. The subsoil ranges from reddish brown to yellowish brown. Included with this soil are a few small areas of Climara and Gaviota soils and areas that have a dark-brown surface layer.

This soil has low fertility. Available water holding capacity is about 3 to 5 inches. Runoff is medium, and the hazard of erosion is moderate.

This soil is used for dryland pasture. Capability unit IVe–1 (15); pasture and range site 6.

Vallecitos loam, 15 to 30 percent slopes (VaE).—This soil is similar to Vallecitos loam, 30 to 50 percent slopes, eroded, but it is less steep. It occurs on rounded hills or on rounded ridgetops in areas of steeper soils. Slopes dominantly range from 20 to 30 percent. Included with this soil are rock outcrops and moderately eroded areas.

On this soil runoff is medium to rapid, and the hazard of erosion is moderate to severe.

This soil is used mostly for dryland pasture, but a few areas are used for dryland grain. Capability unit VIe–1 (15); pasture and range site 6.

Vallecitos loam, 30 to 50 percent slopes (VaF).—This soil is similar to Vallecitos loam, 30 to 50 percent slopes, eroded, but it has a slightly thicker profile. It occurs in large areas in the uplands on somewhat rounded ridgetops.

Included with this soil are small to medium areas of Climara and Montara soils that formed on ultrabasic intrusions. Also included are some small Landslides, small severely eroded areas, soils that have slopes up to 60 percent, and some rock outcrops. Other included areas have a clay loam surface layer.

This soil has low to moderate fertility. Runoff is rapid, and the hazard of erosion is severe. The root zone is shallow to moderately deep.

This soil is used for dryland pasture and for watersheds, wildlife, and recreation. Capability unit VIe–1 (15); pasture and range site 6.

Vallecitos rocky loam, 9 to 30 percent slopes, eroded (VrE2).—This soil is similiar to Vallecitos loam, 30 to 50 percent slopes, eroded, but it is rocky and somewhat less steep. It occurs on low rounded hills or on ridgetops. Outcrops of rock cover from 2 to 10 percent of the surface. Erosion is slight to moderate and occurs mostly around the rock outcrops. The average slope is about 20 percent.

Included with this soil are some small areas of Climara and Montara soils on intrusions of ultrabasic rock. Also included are small areas of soils that have a clay, clay loam, or gravelly surface layer.

This soil has low fertility. Available water holding capacity is about 3 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to severe.

This soil is used for dryland pasture and for watersheds, wildlife, and recreation. Capability unit VIs–5 (15); pasture and range site 6.

Vallecitos rocky loam, 30 to 50 percent slopes, eroded (VrF2).—This soil is similar to Vallecitos loam, 30 to 50 percent slopes, eroded, but it has a thinner profile. It is moderately eroded and occurs on narrow, somewhat angular to rounded, winding ridgetops and on mountainous areas. Slopes dominantly range from 45 to 50 percent. In places this soil is gravelly. Rock outcrops cover 2 to 10 percent of the surface.

Included with this soil are small to medium areas of Montara and Climara soils that formed on ultrabasic intrusions. Also included are soils that have slopes as steep as 60 percent, soils that have a loam or clay surface layer, small Landslides, small severely eroded areas, and small to medium areas of thin soils.

This soil has low fertility. Available water holding capacity is 1 to 3 inches. The root zone is shallow to moderately deep. Runoff is rapid to very rapid, and the hazard of erosion is severe to very severe.

This soil is used for range and for wildlife, watersheds, and recreation. Capability unit VIIs–1 (15); pasture and range site 6.

Willows Series

The Willows series consists of poorly drained, generally clayey, nearly level soils that formed on flood plains in alluvium derived from sandstone and shale. The vegetation is annual grasses and salt-tolerant plants. Elevations are less than 400 feet above sea level, and annual rainfall is less than 14 inches. The average annual temperature is about 60° F., and the frost-free period is about 260 days. The main associated soils are the Clear Lake, Cropley, and Sorrento.

Typically the surface layer is grayish-brown clay that ranges from 24 to 33 inches in thickness. The next layer is yellowish-brown clay that is mottled in the lower part and extends to a depth of about 84 inches.

These soils are slightly saline-alkali in most places, but some areas are moderately to severely saline-alkali.

Willows soils are used for irrigated sugar beets and for dryland grain and pasture.

Willows clay (0 to 2 percent slopes) (Wc).—This soil occurs in the basin of the Bolsa-Soap Lake area and on the floor of a few larger upland valleys. The soil is slightly saline-alkali.

Representative profile: On Turner Ranch, 60 yards north of Bolsa Road and one-quarter mile west of Shore Road intersection; in a field of barley along fence.

Ap—0 to 12 inches, grayish-brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) when moist; moderate, fine, granular structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; abundant, very fine and fine roots; common, very fine and fine, interstitial pores; mildly alkaline; clear, smooth boundary.

A11—12 to 19 inches, grayish-brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) when moist; strong, very fine, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; few very fine and fine roots; few, very fine and fine, interstitial pores; moderately alkaline; gradual, smooth boundary.

A12—19 to 33 inches, grayish-brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) when moist; strong, fine, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; common, very fine and fine, tubular pores; common fine and medium slickensides; moderately alkaline; gradual, smooth boundary.

C1—33 to 57 inches, light yellowish-brown (2.5Y 6/4) clay, olive brown (2.5Y 4/4) when moist; moderate, medium, subangular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; common, very fine and fine, tubular pores; pale-yellow horizontal layers (2 to 3 inches thick) of lime in soft masses; few coatings of material from the A horizon on surfaces of peds and in pores; moderately alkaline; gradual, smooth boundary.

C2g—57 to 84 inches, light yellowish-brown (2.5Y 6/4) clay, olive brown (2.5Y 4/4) when moist; weak, medium, subangular blocky structure; very hard when dry, very firm when moist, sticky and plastic when wet; common, very fine, fine and medium, tubular pores; mottled with gray on ped and pore surfaces; common soft masses and hard nodules of pale-yellow lime; salt crystals in large pores; moderately alkaline, slightly effervescent; gradual, smooth boundary.

In some places the C horizon overlies the surface of a buried soil.

Included in mapping were small areas of Pacheco and Clear Lake soils and areas in which there are buried soils high in organic-matter content.

This soil has low fertility. Available water holding capacity is 7 to 9 inches. Permeability is very slow, runoff is very slow to ponded, and there is no erosion hazard. Plant roots penetrate deeply except where the water table is moderately high.

This soil is used for irrigated sugar beets and dryland grain and incidental pasture. Capability units IIIw–5 (14) and IIIw–5 (15).

Willows clay, saline-alkali (0 to 2 percent slopes) (Wk).—This soil is similar to Willows clay but is moderately to severely affected by salts and alkali. The surface layer is fluffy in most places and ranges from silty clay to clay in texture. Salts and alkali increase with increasing depth. In some places this soil is in small areas surrounded by large areas of other soils. Fertility of the soil is very low.

This soil is used for dryland pasture, but it can be cultivated with the larger areas of surrounding soils. Capability unit IVw–6 (14); pasture and range site 11.

Willows sandy loam (0 to 2 percent slopes) (Ws).—This soil is similar to Willows clay, but its surface layer is 8 to 10 inches of overwash. The overwash ranges from loam to sandy loam in texture but is grayish-brown sandy loam in most places. All of this soil is along medium-sized drainageways. Areas in the Bolsa area have an uneven surface that seems to be a few feet above the surrounding landscape. This soil is slightly saline-alkali. Available water holding capacity is 6 to 8 inches.

Included with this soil in mapping were small areas of Clear Lake soils. In one area of the soil southward from the San Juan-Hollister Road, texture and depth to clay are quite variable and there are minor inclusions of other soils.

Willows sandy loam is used for irrigated sugar beets and for dryland grain and incidental pasture. Capability unit IIIw-5 (14).

Willows soils, eroded (0 to 2 percent slopes) (Ww2).—These soils occur in the Bolsa area on low flats that generally do not have well-defined drainage channels. These soils are moderately affected by salts and alkali in most places, but strongly affected in spots and small areas. Erosion, caused by water running in from surrounding areas, ranges from slight to severe but is moderate to severe in most places. Texture varies from place to place. It is clay in slightly eroded areas, silty clay loam in moderately eroded areas, and clay loam to sandy loam in severely eroded areas. The slightly eroded to moderately eroded areas are characterized by small elongated potholes that have vertical walls and are generally 1 to 2 feet deep. In many places the surface layer of these soils has weak prismatic structure. In severely eroded areas, these soils are rough and gullied and have many small moderately eroded areas rising a foot or more above the general surface. Soil blowing occurs in spots and small areas where the concentration of alkali is severe.

These soils are used for dryland pasture. Capability unit IVw-6 (14); pasture and range site 11.

Yolo Series

The Yolo series consists of well-drained loamy soils that formed in alluvium derived from sandstone and shale. These soils are nearly level to moderately sloping and occupy flood plains and fans. The vegetation consists of annual grasses and forbs and scattered oaks. Elevations range from 400 to 600 feet above sea level. Annual rainfall is 12 to 18 inches. Average annual temperature is about 60° F., and the frost-free period is about 260 days. The main associated soils are the Botella, Gazos, Pleasanton, and Sorrento.

The surface layer is brown to grayish-brown loam and gravelly loam that ranges from 12 to 24 inches in thickness and from medium acid to neutral in reaction. The next layer is pale-brown loam 28 to 40 inches thick. Below this is pale-brown gravelly loam.

Yolo soils are used for dryland grain and incidental pasture.

Yolo loam, 2 to 9 percent slopes (YoC).—This soil occurs on fans, sloping valley floors, and flood plains. Slopes are dominantly between 3 to 6 percent.

Representative profile: On McCreary Ranch in bottom field, one-half mile east of ranchhouse.

Ap—0 to 8 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) when moist; moderate, fine, granular structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; common, very fine and fine, interstitial pores; some fine gravel; medium acid; clear, smooth boundary.

A1—8 to 20 inches, grayish-brown (10YR 5/2) loam, very dark brown (10YR 3/2) when moist; weak, coarse, subangular blocky structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant very fine and fine roots; few, very fine and fine, tubular pores, common, fine and medium, interstitial pores; some fine gravel; slightly acid; gradual, smooth boundary.

C1—20 to 48 inches, pale-brown (10YR 6/3) loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; common, very fine and fine, tubular pores; some fine gravel; neutral; gradual, smooth boundary.

IIC2—48 to 60 inches, pale-brown (10YR 6/3) gravelly loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; common, very fine, tubular pores; mildly alkaline; gradual, smooth boundary.

Included with this soil are some small areas of Botella, Cropley, Pleasanton, and Sorrento soils.

This soil is moderately fertile. Available water holding capacity is 9 to 11 inches. Permeability is moderate, runoff is slow to medium, and the hazard of erosion is slight to moderate. The root zone is very deep.

This soil is used for dryland grain and incidental pasture. Capability unit IIIe-1 (15).

Yolo loam, 0 to 2 percent slopes (YoA).—This soil is similar to Yolo loam, 2 to 9 percent slopes, but it is less sloping. It occurs along the larger drainageways and is subject to occasional flooding in some places. The substratum is stratified and is gravelly or has strata of gravel. Runoff is very slow, and the hazard of erosion is slight to none.

Included with this soil are Botella and Cropley soils and soils that have a sandy loam to light clay loam surface layer.

This soil is used for dryland grain and incidental pasture. Capability unit IIIc-1 (15).

Yolo gravelly loam, 0 to 5 percent slopes (YvB).—This soil is similar to Yolo loam, 2 to 9 percent slopes, but it is less sloping and is gravelly throughout the profile. The surface layer contains 15 percent or more angular gravel, and the substratum is very gravelly and stratified. In some places gullies have been cut by water from the adjacent hills.

Included with this soil are soils on a few toe slopes that have gradients of as much as 5 percent.

Available water holding capacity is about 6 to 8 inches. Permeability is moderately rapid, runoff is very slow to slow, and the hazard of erosion is slight to none.

This soil is used for dryland grain and incidental pasture. Capability unit IIIe-1 (15).

Use and Management of the Soils

The soils in San Benito County are used mainly for range and improved pasture and for growing field crops and irrigated tree fruits, nuts, grapes, and vegetables.

This section tells how the soils can be used for these purposes and also for building highways and other engineering structures.

First described is the system of capability classification commonly used by the Soil Conservation Service but with modifications that are necessary because of climatic differences in the three land resource areas in the county. Capability groups of soils in San Benito County are described, and management of these groups is suggested. Following this is a table that gives estimated yield of crops on important soils for which management is specified. Another table gives the Storie index rating for each soil. Then soils grouped in pasture and range sites are described, and yields of air-dry herbage for each site is estimated. Most of the data on engineering is presented in tables in which properties that affect engineering are estimated and the soils are interpreted according to their suitability for engineering uses.

Capability Groups of Soils

Capability classification is the grouping of soils to show, in a general way, their suitability for most kinds of farming. It is a practical classification based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment. The classification does not apply to rice and other crops having special requirements. The soils are classified according to degree and kind of permanent limitation, but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soils; and without consideration of possible but unlikely major reclamation projects.

In the capability system, all kinds of soils are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest grouping, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. Classes are defined as follows:

Class I. Soils have few limitations that restrict their use.

Class II. Soils have some limitations that reduce the choice of plants or require moderate conservation practices.

Class III. Soils have severe limitations that reduce the choice of plants or require special conservation practices, or both.

Class IV. Soils have very severe limitations that restrict the choice of plants or require very careful management, or both.

Class V. Soils subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife food and cover. (None in San Benito County)

Class VI. Soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.

Class VII. Soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to grazing, woodland, or wildlife.

Class VIII. Soils and landforms have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in San Benito County but not in all parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only subclasses indicated by *w*, *s*, and *c*, because the soils in it are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils.

Capability units in California are given Arabic numbers that suggest the chief kind of limitation responsible for placement of the soil in the capability class and subclass. For this reason, some of the units within the subclasses are not numbered consecutively, and their symbols are a partial key to some of the soil features. The numeral used to designate units within the classes and subclasses are these:

0. A problem or limitation caused by sand and gravel in the substratum (not used in the county).
1. An erosion hazard, actual or potential.
2. A problem or limitation of wetness caused by poor drainage or flooding.
3. A problem or limitation caused by slow or very slow permeability of the subsoil or substratum.
4. A problem or limitation caused by coarse soil texture or excessive gravel.
5. A problem or limitation caused by a fine or moderately fine textured surface soil.
6. A problem or limitation caused by salt or alkali.
7. A problem or limitation caused by cobbles, stones, or rock outcrop (not used in this county).
8. A problem or limitation caused by shallow depth of soil over bedrock (not used in this county).
9. A problem or limitation caused by low fertility or by toxicity.

Land resource areas

In San Benito County, capability classification is further refined by designating the land resource area in which the soils in a unit occur. A land resource area is a broad geographic area that has a distinct combination of climate, soils, management needs, and cropping systems.

The 48 conterminous states in the nation have been divided into 156 land resource areas. Parts of three of these areas are in San Benito County and are shown in figure 13. These areas and their numbers are Central California Coastal Valleys (14); Central California Coast Range (15); and Sacramento and San Joaquin Valleys (17). The number of the resource area is added, in parentheses, to the class, subclass, and unit designation for complete identification of the capability unit.

To place soils consistently into capability units, it is necessary to make assumptions that affect management in a land resource area. In the following paragraphs the land resource areas of which parts occur in San Benito County are described so that local farming can be related to the larger areas. Following the description of each area is a listing of the assumptions made to guide placement of soils into capability classes and units.

Land Resource Area 14 is called Central California Coastal Valleys. This area occurs in the coastal range, except in the northernmost and southernmost parts of California. Temperatures in the area are influenced by nearness to the ocean. Summers are cool near the coast. Daytime temperatures are higher inland, but at night in summer temperatures are lowered by ocean breezes. The frost-free season ranges from a low of about 210 days to slightly more than 300 days near the coast. Annual precipitation ranges from about 14 to 30 inches. The soils in this area developed in alluvium. They range from

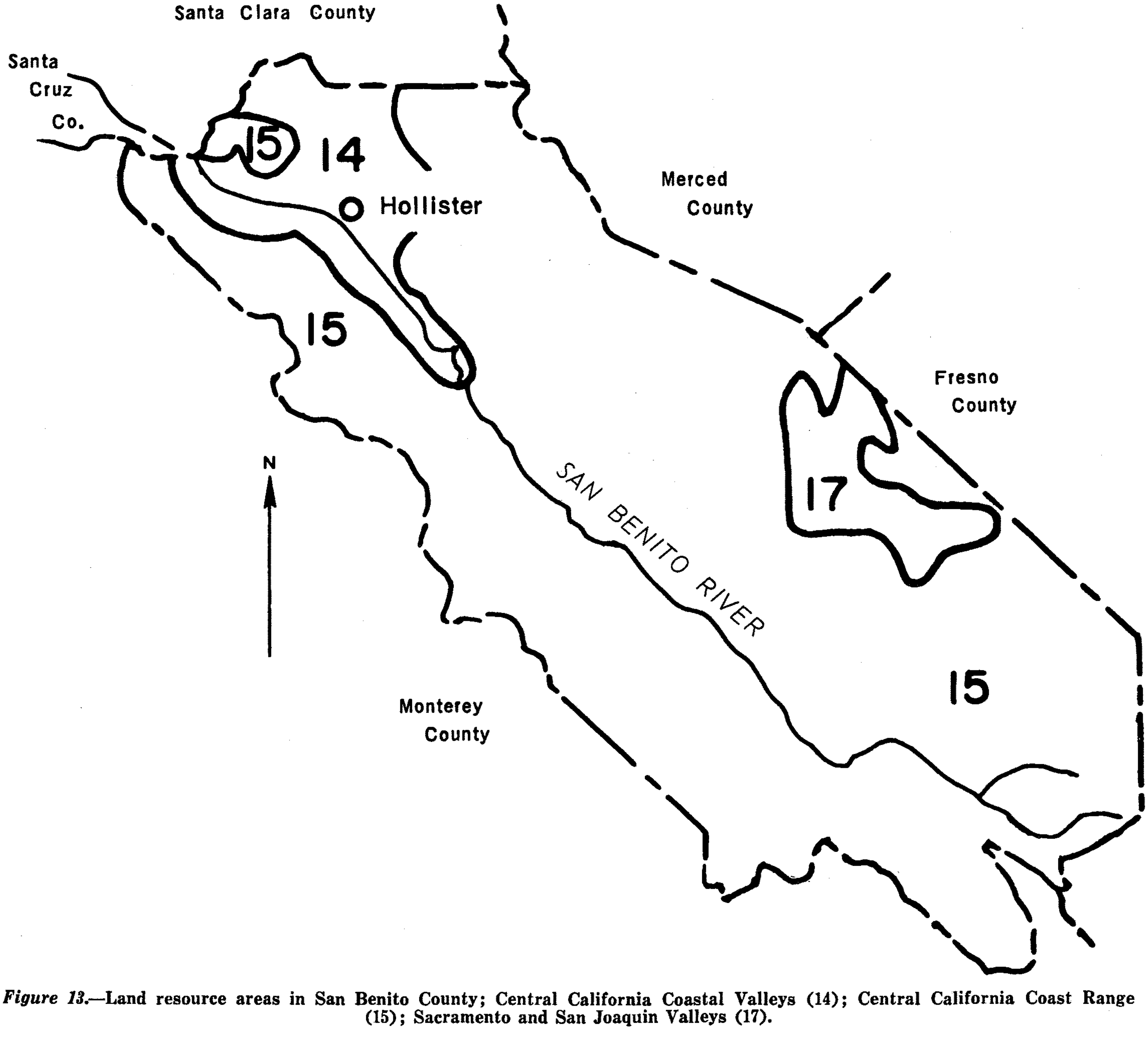

Figure 13.—Land resource areas in San Benito County; Central California Coastal Valleys (14); Central California Coast Range (15); Sacramento and San Joaquin Valleys (17).

poorly drained in basins through well drained in recent alluvium along streams. The soils on terraces have slight to large increases in clay content in the subsoil. They are generally nearly level to gently sloping, though small areas on short slopes are moderately sloping or steep. The principal crops in this resource area are truck crops, fruits, nuts, wine grapes, small grains, and forage. Dairying is important.

The soils in Land Resource Area 14 are placed in capability units on the assumption that—

1. Irrigation water is available for all soils that are suitable for cultivation.
2. Length of growing season or lack of heat does not decrease choice of crops to the extent that the capability class is changed to a less suitable class.
3. Wet soils can be drained, but continuing limitations result from permeability of the soil, difficulty in maintaining drainage facilities, and possible restriction in selection of crops because of other water problems.
4. Damage by flooding has been reduced by structures and channel work, but flooding is a limitation in some places.
5. The level of management is moderately high.

Land Resource Area 15 is called Central California Coast Range. It occupies the foothills of the coastal range of California. The hills and mountains of the northern and southernmost parts of the State are excluded. Also excluded are most areas where elevations are more than 2,500 feet, areas of conifer forests, and areas having more than 30 to 40 inches of precipitation. Within the resource area, precipitation may be as little as 6 inches. The frost-free period is approximately 200 to 300 days. In most places the soils overlie sedimentary rocks, but in San Benito County extensive areas of soils are on granite and basic igneous rocks. The soils range from rolling to very steep. Raising livestock is the main agricultural activity. Only about 6 percent of the soil area is cultivated. About 47 percent is in grass or grass and oak, and 47 percent is in brush that varies in density and is of low grazing value.

The soils in Land Resource Area 15 are placed in capability units on the assumption that—

1. Irrigation water is not available. Limitations in crop selection caused by lack of precipitation affect placement of soils in a capability class. An isolated irrigated soil requires management practices similar to those used in area 14.
2. Soils more than 20 inches deep and soils having more than 3 inches of available moisture capacity are suitable for annual forage plants and may be managed for these plants.
3. Assuming that available moisture capacity is 4 inches in the soil, additional assumptions are as follows:
   - a. Soils having less than 7 inches of precipitation available for evapotranspiration are not suitable for cropping.
   - b. Soils having 7 to 10 inches of water are suitable for small grains.
   - c. Soils having 10 to 12 inches of water have higher yields of grain than the soils with 7 to 10 inches, and in addition can produce low to moderate yields of sudangrass, beans, and grapes.
   - d. Soils with 12 to 16 inches of water produce somewhat higher yields than those with 10 to 12 inches, and in addition can produce some tree fruits and nuts and several kinds of row crops.
4. Other than lack of precipitation and length of frost-free period, the climate does not restrict crop selection enough to affect capability class.
5. The level of management is moderately high.

Land Resource Area 17 is called Sacramento and San Joaquin Valleys. This area occupies all of the central valley in California plus a few small partly isolated valleys, such as Panoche Valley in San Benito County. Only the valley floors and terraces are included in this area. Rainfall ranges from 6 to 22 inches and is about 6 inches in Panoche Valley. Summers are hot and dry, and winters are cool. The frost-free period ranges from 220 to 320 days. More than half of the area is cropland, and many kinds of crops can be grown.

The soils in Land Resource Area 17 are placed in capability units on the assumption that—

1. Irrigation water is available for all soils suitable for cultivation.
2. Climate does not limit crop selection to the extent that the soils should be placed in capability class of less suitability.
3. Many kinds of crops can be grown under irrigation.
4. Overflow and drainage are not problems in the San Benito County part of the area.
5. The level of management is moderately high.

Management by capability units

In the following pages, the capability units of San Benito County are described and management for the soils in these units is suggested. The mention of the soil series in these descriptions does not mean that all the soils in a series are in the capability unit. To determine the soils in each unit, refer to the "Guide to Mapping Units" at the back of this survey. Because the placement of the soils into capability units in San Benito County partly depends on land resource areas, each soil that occurs in two of these areas is in two capability units. There are many soils in the county of this kind.

In the following descriptions of the capability units, available water holding capacity applies to the effective root zone, or to the depth that plant roots generally penetrate.

CAPABILITY UNIT I-1 (14)

Soil in this unit are very deep, well drained, moderately coarse textured to moderately fine textured, and nearly level. These soils are in the Botella, Hanford, Mocho, Salinas, Sorrento, and Reiff series. The surface layer and underlying layers range from sandy loam to silty clay loam. Some soils in this unit have relatively uniform texture throughout the profile, but others have strata of different texture. Roots readily penetrate these soils to a depth of 60 inches or more. Permeability of the subsoil ranges from moderately rapid to moderately slow.

Available water holding capacity ranges from about 7.5 to 12.0 inches.

The surface layer ranges from medium acid to moderately alkaline. Lower layers tend to be more alkaline than the surface layer and, in large areas, are calcareous. Problems related to reaction or to lime are rare or minor. Slopes are less than 2 percent, and the erosion hazard is none to slight. The soils in this unit occupy the valley bottoms in the San Juan-Hollister area, the lower reaches of the San Benito River, and the bottoms along Tres Pinos Creek and a few small side creeks.

Many kinds of crops are grown on these soils. Among those grown are apricots, apples, prunes, pears, walnuts, wine grapes, sugar beets, tomatoes, potatoes, beans, peppers, garlic, onions, lettuce, cabbage, squash, flower and vegetable seeds, small grains, alfalfa, and pasture. Small grains are dryfarmed, but the other crops are usually irrigated. Field crops other than small grains and some orchard crops can be dryfarmed, though plant growth is not so good as in irrigated areas.

Land leveling is needed if irrigation water is applied by furrows or borders. By timing and regulating the irrigations, the water can be applied uniformly so that it does not pond or cause erosion. Application needs to be timed so that the crop receives enough water, but not too much. For most crops sprinkler irrigation is as suitable as the furrow or border method.

All soils in this unit need green manure, crop residues, and other organic matter that helps to maintain favorable soil structure, tilth, and infiltration rates. Except for soils in orchards, crop rotation should be used to offset the buildup of pests and disease, as well as the loss of plant nutrients. If tillage is kept to a minimum, structure and infiltration are improved. Tillage pans are common in many areas, where they adversely affect all except the most shallow-rooted crops such as lettuce. Compaction is greater for moist soils than for dry ones. Excessive travel and tillage between tree rows are particularly harmful in orchards. Deep tillage breaks up tillage pans, but it should not be used in orchards where too many roots will be cut.

Nitrogen fertilizer is needed for all crops except alfalfa and, at times, beans. Alfalfa generally responds to phosphorus fertilizer. A number of truck and field crops grow better if both phosphorus and potassium are added.

CAPABILITY UNIT I-1 (17)

The soils in this unit are very deep, are well drained, have a moderately coarse textured to medium-textured surface layer, and are nearly level. These soils are in the Panoche series. They are similar to the soils in capability unit I-1 (14), but they are in the San Joaquin-Sacramento Valley resource area where summer temperatures are high and crop selection and management are somewhat different.

In these soils roots penetrate to a depth of 60 inches or more. Except for stratification in some areas, the soils are, from the surface downward, nearly uniform in texture, reaction, color, permeability, and content of lime and of organic matter. Available water holding capacity ranges from about 8.0 to 11.0 inches. These soils are calcareous, but the lime does not cause chlorosis in the crops commonly grown. Noticeable tillage pans have not developed. The hazard of erosion is none to slight. The soils in this unit occupy the Panoche and Vallecitos Valleys.

These soils are used for cotton, alfalfa hay, alfalfa seed, safflower, wheat, and barley. They are also used for irrigated pasture, wine, table, and raisin grapes, melons, tomatoes, sugar beets, beans, and many kinds of tree fruits and nuts. In local areas the hazard of winter and spring frosts affects the choice of fruit and nut crops.

Because the supply of irrigation water is limited, extra care is needed in use of water. If the border or furrow method is used, these soils need to be smoothed. The rate of water application, direction of run, and timing need to be controlled so that plant growth is uniform and there is no ponding, excessive losses of runoff, or deep percolation.

Sprinklers may be used in place of furrows and borders or in conjunction with them. Careful land leveling is not needed where sprinklers are used, but the sprinklers should be designed and used in a way that accomplishes the same objectives as land leveling.

Crop rotation helps to offset the buildup of pests and disease and to improve the seedbed. Crop residues, green manure, barnyard manure, or other organic material improves or helps maintain favorable soil structure and infiltration.

All crops except legumes need nitrogen fertilizer; alfalfa needs phosphorus. Application of potassium and of minor elements commonly is not needed.

CAPABILITY UNIT IIe-1 (14)

Soils in this unit are very deep, well drained, moderately coarse textured to medium textured, and gently sloping to moderately sloping. These soils are in the Botella, Hanford, Mocho, Pleasanton, Reiff, and Sorrento series. The surface layer ranges from sandy loam to silt loam. Many of the soils are slightly stratified and have texture as fine as clay loam in the lower layers. Permeability is generally moderate and moderately rapid throughout the profile, but some soils have moderately slow permeability in the lower horizons. In most places roots penetrate to a depth of 60 inches or more, but there is some restriction to penetration of roots, particularly in the Pleasanton soil. This restriction affects the growth of orchard trees, particularly nut trees. Available water holding capacity is about 7.0 to 11.0 inches.

The surface layer and lower horizons generally range from slightly acid to moderately alkaline, but a number of soils are more alkaline in the lower horizons. Many of the soils are calcareous. Slopes range from 2 to 9 percent, and the hazard of erosion is slight to moderate. These soils are in the northern third of the county. They occupy small valleys and fans on the edge of the main valleys.

These soils are used for apricots, apples, prunes, pears, walnuts, wine grapes, alfalfa hay, pasture, and field and truck crops. Small grain is grown without irrigation. Nonirrigated field crops and fruit and nut crops are not produced if irrigation water can be obtained at a reasonable cost.

Sprinkler irrigation has advantages over surface methods because irrigation water and its application can be better controlled. In only a few places can the border method be used. If furrows are used, they should be laid out on a grade of about 0.5 percent so that the soils can be uniformly moistened and erosion or the breaking of the furrows prevented. Some leveling and smoothing normally is needed to avoid awkward pieces, point rows, and dry spots. This leveling lowers the content of organic matter, and temporarily the level of plant nutrients, but only in the Pleasanton soil does it expose unfavorable subsoil material. If cuts of more than 2 feet are to be made, the soils should be examined carefully so as to insure that gravel or sand is not exposed. Regardless of the irrigation method used, the water should be applied at times and at rates that favor crop growth but do not cause erosion or loss of water.

Particularly during rainy periods, organic material is needed on the surface of these soils for protection. Close-growing plants, plant residues, and mulches are needed to slow runoff and to increase infiltration. Where slopes are long, diversions are needed to convey water safely to nonerosive channels or streambeds. Where tillage is performed across the slope or on the contour, the small ridges created will slow runoff, increase infiltration, and help to convey the excess water from the field. Crop rotations can be used to improve soil structure and minimize disease and pests on soils in orchards.

Nitrogen fertilizer benefits all crops except alfalfa. Alfalfa responds to phosphorus.

CAPABILITY UNIT IIe-1 (17)

Soils in this unit are very deep, moderately coarse textured and medium textured, and gently sloping to moderately sloping. These soils are in the Panoche series. They are readily penetrated by roots to a depth of 60 inches or more. Texture ranges from sandy loam to loam. The lower layers have about the same texture as the surface layer, though there is some stratification. Soil permeability is moderate to moderately rapid. Available water holding capacity ranges from about 8.0 to 11.0 inches.

These soils are moderately alkaline. They are calcareous throughout the profile, but lime-induced chlorosis is not likely. Slopes range from 2 to 9 percent, and susceptibility to erosion is moderate unless these soils are properly managed. The irrigation of sloping soils presents some problems. The soils in this unit occur in Panoche and Vallecitos Valleys but are not extensive.

These soils are used for alfalfa hay, alfalfa seed, safflower, wheat, and barley. Many other irrigated crops can be grown.

Irrigation water is not plentiful. The timing of irrigations and the amount of water applied should be regulated so that drought is prevented but water is not lost through deep percolation and runoff. Water applied in furrows on a grade of about 0.5 percent is evenly distributed and does not cause erosion or break the furrows. Some soil leveling is generally needed so as to avoid awkward pieces and point rows. In this leveling, the subsoil material exposed is favorable for crop growth, though yields in areas where material has been removed may be temporarily reduced.

Use of sprinkler irrigation is advantageous because little or no leveling is needed, awkward furrow layouts can be avoided, and the time, amount, and rates of application can be readily adjusted. Some protection from erosion by runoff is provided by crop residues left on the surface or sticking out of the soil. A crop rotation helps to improve soil structure and infiltration if many fine roots and plentiful crop residues are mixed into the soil. Crop rotations also minimize the buildup of pests and disease. Damaging runoff is slowed by tilling on the contour. Nitrogen fertilizer benefits all crops except alfalfa. Alfalfa responds to phosphorus.

CAPABILITY UNIT IIe-5 (14)

Soils in this unit are very deep, well drained, moderately fine textured to fine textured, and gently sloping to moderately sloping. These soils are in the Cropley, Mocho, Rincon, Salinas, and Sorrento series. The surface layer and lower horizons range from clay loam to clay. Permeability is moderately slow to slow. Most slopes are between 2 and 9 percent.

These soils generally are penetrated by roots to a depth of 60 inches or more, but penetration is restricted by fine texture and dense horizons in the subsoil. Available water holding capacity ranges from about 8.0 to 12.0 inches. In the upper horizons, some of these soils are slightly acid to neutral and others are alkaline and calcareous. All of the soils are calcareous in the lower horizons. Some tree fruits are slightly susceptible to chlorosis caused by lime. Rill and gully erosion is a slight to moderate hazard unless these soils are protected. The more clayey soils are somewhat difficult to till. The soils in this unit occur around the side of the main valley and in sloping small valleys.

Many crops are grown, among them irrigated apricots, prunes, walnuts, sugar beets, tomatoes, beans, alfalfa, and pasture. Small grains are grown without irrigation, but other crops do not grow well unless they are irrigated.

The protection of organic material on the surface is needed to reduce soil erosion during the rainy season. Close-growing plants, crop residues, or mulches slow runoff water and improve infiltration. If the tillage before the rainy period is on the contour or across the slope, the small ridges created will slow runoff and aid infiltration. On longer slopes, or where water comes from the hills above, diversions are needed to convey the water to stabilized channels or streambeds. By using crop rotations that reduce tillage and increase fine roots and residues, erosion is reduced because soil structure is improved. Rotations also lessen the buildup of pests and disease.

Because of slope, the border method of irrigation is suitable only in a few small areas. If furrows are used for irrigation, the grade should be from 0.3 to 0.7 percent so that water infiltrates without undue runoff at the end of the furrows and without soil loss through erosion. The amount of water should be controlled so as to avoid breaking the furrows. Some leveling and smoothing may be needed to improve layout and to avoid point rows, dry spots, and awkward pieces. If cuts are deeper than 18 inches, growth of plants may be temporarily lowered. Seedbed preparation, particularly on the Rincon soils, is difficult where the subsoil is exposed.

Sprinklers can be used on these soils, provided water is applied at rates adjusted to the infiltration rate of the clayey soils. Whatever method is used, irrigation should be at times and rates that favor crop growth but do not waste water or promote erosion. Tillage requirements of tractor power tend to be high, particularly as the soils become dry. If these soils are worked when wet, large clods form and tilth is worsened. Distinct tillage pans, however, do not develop in these soils.

Nitrogen fertilizer benefits all crops except alfalfa. Alfalfa responds to phosphorus. Potassium probably is not needed for common crops.

CAPABILITY UNIT IIw-2 (14)

Soils in this unit are very deep, somewhat poorly drained, moderately coarse textured to moderately fine textured, and nearly level. These soils are in the Metz and Pacheco series. The surface layer ranges from sandy loam to clay loam. In some places the lower layers are considerably stratified with loamy sand and sand. Permeability ranges from rapid to moderately slow. Originally, these soils had a water table that generally fluctuated between depths of 36 and 60 inches. In places it was temporarily nearer to the surface than 36 inches. By pumping and improving drainage, the water table was lowered in many areas, and it rises only a little above 60 inches.

Roots penetrate these soils to a depth of 60 inches, except in those areas where wetness limits penetration. Available water holding capacity generally ranges from 5.0 to 12.0 inches. The soils in this unit are mildly alkaline to moderately alkaline. Generally, they are not calcareous in the surface layer but are moderately alkaline and calcareous in the lower layers. Slopes are generally less than 1 percent, and erosion is not a hazard. Some areas are flooded, but flooding is infrequent and occurs in winter when crops are not growing on these soils. Only small areas are affected by salt. The soils in this unit occur mostly north and west of Hollister, though there is a small area south and east of San Juan Bautista.

Irrigated crops commonly grown on these soils are sugar beets, tomatoes, alfalfa, truck crops, walnuts, and wine grapes. These crops do not grow well unless they are irrigated. Small grains, however, are grown without irrigation. Because these soils occur in low positions, frosts late in spring discourage the planting of apricots and other sensitive crops.

For these soils the widest selection of crops can be made if excess water is removed by drainage ditches and pumping. In some places tile drains are also needed. Drainage is particularly needed for the deeper rooted, long-lived plants such as orchard trees and alfalfa. Crop rotations that provide many fine roots and large amounts of organic residues aid in the maintenance of favorable soil structure and infiltration. Tillage should be kept at a minimum so that tilth is maintained.

All crops grown except alfalfa respond to nitrogen fertilizer. Phosphorus is beneficial to alfalfa and other legumes. Potassium improves the quality of some truck crops.

CAPABILITY UNIT IIs-4 (14)

Soils in this unit are very deep, well drained and somewhat excessively drained, moderately coarse textured, and nearly level. These soils are in the Hanford, Metz, and Sorrento series. They have a coarse sandy loam, sandy loam, or gravelly loam surface layer. Their lower layers are of the same or coarser texture. Plant roots can penetrate to a depth of 60 inches or more. Permeability of the lower horizons ranges from moderately rapid to rapid. Available water holding capacity is about 5.0 to 9.0 inches. Stratification, however, causes considerable variation in some places.

These soils range from slightly acid to moderately alkaline. Slopes are generally less than 2 percent but are as much as 5 percent in some places. The hazard of erosion is none to slight. These soils occur with and are similar to the soils in capability unit I-1 (14), though they are more droughty and less fertile. In many places the soils are along major streams where flooding is infrequent.

These soils are used for irrigated apricots, walnuts, grapes, tomatoes, potatoes, other truck crops, beans, alfalfa, and pasture. Without irrigation, trees in orchards do not grow well and truck crops and most row crops are not grown. Small grains, however, are grown without irrigation.

If management is intensive, crops grow about as well on these soils as they do on the soils in capability unit I-1 (14), but irrigation water and fertilizers have to be applied more frequently and with more care so as to prevent losses through leaching. Also, shorter furrows and borders are needed. By soil leveling and controlling the rate of applying water, these soils can be evenly moistened without erosion and the loss of runoff. Sprinkler irrigation allows better control of the time and amounts of the applications. Where deep cuts or extensive earthmoving are planned, the areas should be thoroughly investigated. Because these soils are stratified with sand and gravel, it may be difficult to prepare them for irrigation and to irrigate them. These soils benefit if crop rotations that add roots and other organic matter are used, or if organic matter from any source is added.

Additions of nitrogen improve the growth of most crops, but their benefits to alfalfa are marginal. Legumes respond to additions of phosphorus, and some truck crops respond to additions of potassium.

CAPABILITY UNIT IIs-5 (14)

Soils in this unit are very deep, well drained to moderately well drained, moderately fine textured to fine textured, and nearly level. These soils are in the Clear Lake, Cropley, Pacheco, and Rincon series. Their surface layer is clay, silty clay, silty clay loam, or loam, and the subsoil ranges from clay to clay loam. Permeability is generally slow but is moderately slow to very slow in some places. Available water holding capacity is about 8.0 to 12.0 inches.

Reaction in the surface layer ranges from neutral to moderately alkaline, but the surface layer is noncalcareous. The subsoil is moderately alkaline and calcareous. Slopes are less than 2 percent and, in some places, are less than 1 percent. Erosion is not a hazard.

Because of the clay in these soils, requirements of tractor power for plowing and other tilling are high and preparation of the seedbed is difficult. Many of the areas were poorly drained, but they have been artificially drained and the water table has been lowered. These soils are fertile.

Crops commonly grown under irrigation on these soils are apricots, walnuts, pears, prunes, sugar beets, tomatoes, beans, many truck crops, alfalfa, and pasture. A number of these crops can be grown without irrigation, though they do not grow so well. Small grains are grown without irrigation.

Leveling and irrigation layout should be planned so as to provide even distribution of moisture without ponding at the end of fields. Sprinklers can be used in place of other methods. The time of irrigations and the amount of water applied depend on the needs of the crops grown. Crop rotations that add many fine roots add substantially to the organic matter. By decreasing tillage, structure and infiltration are improved. Manure and other organic material mixed into the soil are also beneficial. If cuts deeper than 18 inches are planned, particularly on Rincon soils, soil structure is worsened and soil fertility is lowered.

All crops except legumes respond favorably to nitrogen fertilizer. Additions of phosphorus benefit legumes, and additions of potassium benefit some special truck crops.

CAPABILITY UNIT IIIe-1 (14)

Soils in this unit are deep, well drained, medium textured, and gently sloping to moderately sloping. These soils are in the Pleasanton and Rincon series. The surface layer is loam or gravelly loam that permits easy penetration by roots. At a depth of 18 to 24 inches, the subsoil is clay loam, gravelly clay loam, or heavy clay loam and is moderately slow to slow in permeability. It restricts development of roots. Below a depth of 40 inches, and soils are very gravelly in some places, but few roots extend below 60 inches. Available water holding capacity is about 5.0 to 9.0 inches.

The surface layer ranges from medium acid to neutral, but the subsoil is generally more alkaline. The Rincon soils are calcareous in the lower part. Slopes range from 2 to 9 percent but are mostly between 5 and 9 percent. The hazard of erosion is slight to moderate. These soils occur on benches along the main valley and extend from Paicines northwestward to Santa Clara County.

These soils are used for irrigated prunes, apricots, wine grapes, and pasture. Small grains, hay, and pasture plants are grown without irrigation. Because air drainage is slightly better than in most areas, fruit trees have an advantage in avoiding damage by frost in spring. Row crops could be grown on these soils, but the difficulties of irrigation and the cost of pumping tend to discourage such use.

The timing of irrigations should be adjusted to the needs of the crop. Surface applications should be used only with contour furrows. Sprinklers have an advantage on the steeper more uneven slopes. The water should be applied slowly enough to avoid loss in runoff, as well as loss of soils through erosion. In leveling these soils, cuts of more than 12 to 18 inches are undesirable because deep cuts expose subsoil material that has slow infiltration rates and unfavorable soil structure.

During the rainy periods, these soils need the protection of organic mulches and of crop residues in and on the surface layer. Crop rotations that provide fine roots and other organic material improve soil structure and decrease runoff, particularly if these rotations allow reduced tillage. In orchards cover crops are needed in winter. Tilling on the contour leaves ridges that slow runoff. Orchards and vineyards should be planted on the contour. On fields that do not have a good cover of vegetation, diversions and terraces are needed and water from them should be carried safely to outlets through grassed waterways.

Nitrogen fertilizer benefits all crops commonly grown on these soils, but it is uncertain whether response to phosphorus and potassium fertilizers will be favorable.

CAPABILITY UNIT IIIe-1 (15)

Soils in this unit are very deep, well drained, moderately coarse textured to medium textured, and gently sloping to moderately sloping. These soils are in the Arguello, Botella, Hanford, Mocho, Reiff, Sorrento, and Yolo series. They are the same kinds of soil or are similar to the soils that are in capability unit IIe-1 (14), but they occur in small valleys in the foothills where irrigation water is not available.

These soils have a surface layer and subsoil of silt loam, loam, sandy loam, coarse sandy loam, or gravelly loam, except for a few less permeable soils that have a clay loam subsoil. Permeability of the subsoil ranges from moderately rapid to moderately slow. Available water holding capacity ranges from 6.0 to 12.0 inches.

The surface layer and lower horizons range from strongly acid to moderately alkaline in reaction. Slopes range from 2 to 9 percent, and the hazard of erosion ranges from slight to moderate.

The choice of crops is limited by lack of precipitation and available irrigation water. These soils are used for dryland small grains, beans, sudangrass, wine grapes, and a few tree fruits. Many areas are used for pasture and range, along with soils of adjacent hills.

During rainy periods, erosion is controlled by crop residues or stubble left on and near the surface or by close-growing crops. In vineyards and orchards volunteer or seeded cover crops help control erosion. If the crops are allowed to grow vigorously in spring, they seriously deplete the stored moisture. Runoff is slowed where these soils are tilled on or near the contour before the rainy season. Orchards and vineyards should be planted on the contour. A crop rotation that provides fine roots and crop residues improves infiltration and the growth of crops. Where runoff from the hills crosses fields or where slopes are long, diversions are needed to convey water to controlled outlets.

Applications of nitrogen and phosphorus fertilizers generally benefit most crops, except in years when rainfall is below average.

CAPABILITY UNIT IIIe-3 (14)

Soils in this unit have a claypan and are moderately deep, medium textured, and gently sloping to moderately sloping. These soils are in the Antioch series. The surface layer is loam that is moderately permeable and favorable to the growth of roots. The subsoil occurs at a depth of 12 to 20 inches and consists of dense clay that is very slowly permeable and unfavorable to the growth of roots. The part of these soils occupied by roots can hold about 3.75 to 5.0 inches of water. These soils are moderately well drained and well drained, but the zone just above the claypan may be saturated for a week or more following a rainy period or an irrigation.

Reaction is about medium acid in the surface soil but is moderately alkaline deep in the subsoil. Slopes range from 2 to 9 percent, and the hazard of erosion is moderate unless these soils are protected. Other limitations to use are the restricted root zone and permeability in the subsoil. These soils occur on benches and terraces along the east side of the main valley. They extend from a point about 12 miles south of Hollister to 8 miles north of it.

These soils are used for irrigated prunes, apricots, tomatoes, and a few row crops and pasture. Air drainage and availability of water favor fruit trees more than soil quality does. Walnuts and a few other crops may be grown in parts of fields consisting mainly of other soils. Small grains and pasture plants are grown without irrigation.

Irrigation can be by contour furrows, though the layout and water control may be difficult. Close attention to the amount and timing of the irrigation is required for preventing drought or temporary waterlogging. Sprinklers may have some advantages because the time and amount of application can be regulated more closely. Spur rows and complicated layouts should be avoided. Because the subsoil is unfavorable for the growth of plants, soil leveling and smoothing are practical in only a few areas. Plants grow poorly where the subsoil is exposed or where the surface soil is thinned.

During rainy periods a close-growing crop, organic residues, and stubble are needed for protection against erosion. In orchards a cover crop is needed. Areas in field and row crops benefit from a crop rotation that improves soil structure, reduces tillage, and adds organic matter. Tillage should be on the contour so that the small ridges created will slow runoff and increase infiltration. In some locations diversions and terraces are needed where there is not enough vegetation for protection. Terraces should be designed so as to prevent channel erosion, silting, or breakovers.

CAPABILITY UNIT IIIe-3 (15)

This unit consists of deep, well-drained, gently sloping to moderately sloping soils that have a medium-textured surface layer and a subsoil with moderately slow to slow permeability. These soils are in the Pleasanton and Rincon series. They are the same kinds of soils as are in unit IIIe-1 (14) or are similar to them. Management requirements differ, however, because the soils in unit IIIe-3 (15) occur in the foothills where irrigation water is not available.

The soils in this unit have a loam or gravelly loam surface layer that is favorable to the growth of roots. At a depth of about 20 inches, the soil material is less permeable for it consists of clay loam, heavy clay loam, or gravelly clay loam. Some soils are very gravelly below a depth of about 40 inches. Few roots extend below 60 inches. The soils in this unit hold about 7.0 to 10.0 inches of available water.

The surface layer ranges from medium acid to about neutral in reaction, but the subsoil is more alkaline. Some soils are calcareous in the lower part. Slopes range from 2 to 9 percent, and the hazard of erosion is moderate to high unless these soils are protected. The soils in this unit occur on benches on the sides of parts of the main valley in the northern half of the county.

These soils are used for dryland small grains, a few row crops, sudangrass, wine grapes, apricots, and prunes. Some areas next to more extensive areas of rangeland are used for pasture. Except for grain and pasture plants, crops do not grow as well on these soils as they do on similar soils in unit IIIe-1 (14) when they are irrigated.

Close-growing plants, crop residues, stubble, and other organic matter on or near the surface reduce the hazard of erosion. Crop rotations should be those that protect the surface during the rainy periods. In these rotations grass is used, tillage is reduced, and crop residues are not removed. Tillage should be on or near the contour so that runoff is slowed and infiltration is increased. In a few places diversions and terraces may be needed. For these, outlets should be protected, the waterways grassed, and channels protected so that they convey the water without eroding. A winter cover crop is needed in orchards and vineyards. In spring growth of the cover crop should be checked so that a reasonable amount of moisture remains for the trees or vines.

Crops generally respond favorably to nitrogen and phosphorus fertilizers, if the supply of moisture is good.

CAPABILITY UNIT IIIe-4 (14)

Soils in this unit are very deep, well drained and somewhat excessively drained, moderately coarse textured, and gently sloping to moderately sloping. These soils are in the Metz and Hanford series. They have a surface layer of coarse sandy loam or gravelly sandy loam. Texture is the same in the lower horizons, or there are thick layers of loamy sand to sand. Generally these soils are stratified. The lower horizons have moderately rapid to rapid permeability; roots readily penetrate to a depth of 60 inches or more. Available water holding capacity is about 4.0 to 8.0 inches.

Reaction in these soils ranges from slightly acid to moderately alkaline and generally is a little more alkaline in the lower part than at the surface. Slopes range from 2 to 9 percent, and in unprotected areas the hazard of erosion is generally moderate but is slight in some places. These soils occur along the small narrow valleys in the northern half of the county. In small areas there are infrequent flooding, bank cutting, and channel changes. Rainfall is about average.

These soils are used for irrigated grapes, walnuts, and alfalfa. Some areas are used for dryland grain and pasture. In many areas adjacent to hilly soils used for range, these soils are used for range and pasture.

Irrigation water needs to be applied frequently on these soils because the capacity for storing moisture is below average. Surface methods of irrigation can be used. Contour furrows and short runs are needed for avoiding excessive loss of water through deep percolation and to provide uniform distribution of moisture without soil erosion. Sprinklers have some advantages, for the rate and amount of water can be closely controlled if they are used. Some smoothing and leveling of land may help irrigation, particularly if surface methods are used. Before any deep cuts are made, however, the area should be investigated. Advantages of leveling may be offset if it exposes excessively sandy gravelly layers.

These soils have low fertility, and they benefit from crop rotations that provide large amounts of crop residues and roots. Crop residues and stubble left on and near the surface during the rainy periods help control erosion, but vigorous close-growing plants are more effective. A cover crop is needed in orchards and vineyards.

Additions of fertilizer are required for good crop growth. All crops except alfalfa respond to nitrogen and phosphorus fertilizers. Additions of potassium may not be economically feasible. In dryland areas the benefits from fertilizers are uncertain.

CAPABILITY UNIT IIIe-5 (15)

This unit consists of moderately deep to very deep, well-drained, moderately fine textured to fine textured soils that are gently sloping to strongly sloping. These soils are in the Climara, Conejo, Cropley, Diablo, Gazos, Linne, Mocho, Nacimiento, Rincon, Salinas, San Benito, and Sorrento series. All of the soils are more than 36 inches deep to soft or hard rock, and some are more than 60 inches. Roots penetrate all of the soil, but in some areas penetration is restricted by the fine texture.

The surface layer ranges from clay loam to clay, and generally the surface layer and lower horizons are similar in texture. Permeability is moderately slow to slow. Many of the soils less than 60 inches deep have slopes of 9 to 15 percent. Available water holding capacity is about 5.0 to 12.0 inches.

The surface layer generally ranges from slightly acid to moderately alkaline. It is calcareous in some places. Most of the lower layers of these soils are moderately alkaline and calcareous. The content of organic matter ranges from about 1.5 to 2.5 percent. Some of the soils in the unit are the same as those in unit IIe-5 (14), which have irrigation water available. Others are more varied and are not so favorable for farming because they are more sloping and the hazard of erosion is slight to high. Tillage, particularly in the clay soils, is somewhat difficult.

These soils are used for dryland small grain, sudangrass, beans, and a few other field crops. Other dryland crops can be grown, but unless irrigated, they do not grow well. These soils are used for grazing in many areas where they are next to extensive areas used for grazing. One soil, Rincon silty clay loam, 9 to 15 percent slopes, eroded, is irrigated in a few small areas.

The soils in this unit need the protection of close-growing plants during rainy periods. Crop residues, stubble, and other organic mulches also help control erosion. A crop rotation that provides a large amount of grass roots is beneficial. Soils not covered with close-growing plants need the protection of crop residues during rainy periods. If these soils are tilled on or near the contour before rainy periods, the small ridges created will slow runoff. Some farmers plow deeply on the contour so as to open up the subsoil and allow faster infiltration and percolation. If these soils are used for orchards and vineyards, winter cover crops or organic mulches should be used for protection.

When rainfall is normal or above normal, crops respond favorably to additions of nitrogen fertilizer.

CAPABILITY UNIT IIIw-5 (14)

Soils in this unit occur in basins and are poorly drained, fine textured to moderately fine textured, and nearly level. These soils are in the Clear Lake and the Willows series. The surface layer is generally clay, though a soil with a sandy overwash occurs in a small acreage. The lower layers are clay or silty clay in most places, but some strata have a coarser texture. The subsoil is slowly to very slowly permeable. Originally, these soils were poorly drained and very poorly drained, but in most areas the water table has been lowered by pumping or by other means. In most places the seasonal water table is within 36 to 60 inches of the surface.

Because of wetness and the finer textured subsoil, few roots penetrate below a depth of 36 inches. Available water holding capacity ranges from about 6.0 to 10.0 inches. The surface layer is generally alkaline; it is not calcareous. Lower layers are calcareous and moderately alkaline, and in places spots of alkali slow plant growth and damage soil structure. Slight to moderate quantities of salt are generally present. The stronger concentrations are in a spotted pattern. After a period of irrigation, the surface layer may be relatively free of salt. Slopes are less than 1 percent, and erosion is not a hazard. Local areas have been flooded, but flooding generally occurs during periods when crops are not grown on these soils. Other management problems are related to texture, drainage, and salt. The soils of this unit occur in the Bolsa area, north and west of Hollister.

These soils are used for irrigated sugar beets, alfalfa, and pasture. Tomatoes, other truck crops, and field crops are grown in small areas. Small grains are dryfarmed, and some areas are used for dryland pasture.

Drainage ditches are needed to hold the water table down and to remove tail water. In some places protection from flooding is also needed. Tile drains generally are not economical; close spacing of tile is necessary because of fine texture and slow permeability. Salts need to be washed out of the upper layers of these soils, but wetness is increased if too much water is applied. Soil leveling is needed so that water can be applied uniformly to promote even crop growth and to avoid the enlargement of salt spots. Irrigation by borders and furrows is generally favored because most areas have a smooth surface. Sprinklers also can be used. Infiltration rates and tilth are improved if crop rotations are used and the crops grown provide large amounts of crop residues and grass roots. Crop rotations also help to reduce pests. Additions of manure or other organic material are also beneficial.

All crops except alfalfa respond to nitrogen fertilizer. Alfalfa responds to phosphorus. Potassium is generally in adequate supply.

CAPABILITY UNIT IIIw-5 (15)

Soils in this unit are deep, poorly drained or somewhat poorly drained, fine textured or moderately fine textured, and nearly level. These soils are in the Clear Lake, Edenvale, and Willows series. They occur in areas where irrigation water is not available, but some of them also occur in units IIs-5 (14) and IIIw-5 (14), where irrigation water is available. In most places permeability is slow in the surface layer and subsoil, but in some places it is very slow in the subsoil. Roots, however, penetrate to a depth of 60 inches or more except in a few areas that have a seasonally high water table. Edenvale clay, 0 to 2 percent slopes, is generally somewhat poorly drained, and the other soils are poorly drained, but in most places the water table has been lowered. Available water holding capacity is about 7.0 to 10.0 inches.

The surface layer is neutral to moderately alkaline. It is calcareous in places. Lower layers are strongly alkaline and contain salt and alkali. Slopes are less than 2 percent. Erosion is not a hazard, but there is a slight hazard of flooding in some areas. Use of these soils is limited mainly by lack of moisture in summer, difficulty in preparing a seedbed, slow permeability, and the presence of salt. These soils occur in basins in the northern part of the county.

These soils are used for small grain, sudangrass, and pasture. Beans, apricots, and other crops could also be grown without irrigation, but crop growth is not good, and these soils are not farmed extensively. Requirements for tractor power are high when these soils are dry, and working them when wet makes them cloddy and their seedbed poor. A crop rotation that produces many fine roots aids soil structure. Crop residues returned to the soil, and any organic matter added, help to maintain soil structure and fertility.

In years of average or above average rainfall, all crops respond well to nitrogen fertilizer.

CAPABILITY UNIT IIIs-3 (14)

Antioch loam, 0 to 2 percent slopes, is the only soil in this capability unit. This soil is moderately deep and medium textured. Its loam surface layer favors the growth of roots, but the very slowly permeable clay subsoil restricts the growth of roots. Depth to the claypan ranges from 12 to 22 inches. About 3.75 to 5.0 inches of water is held in the surface layer and the part of the subsoil occupied by roots. The soil above the claypan may be saturated with water for a week or more following a rainy period or an irrigation.

Reaction in this soil is about medium acid in the surface layer but is moderately alkaline deep in the subsoil. Slopes are generally less than 2 percent, and the hazard of erosion is slight. Use of this soil is limited mainly by the very slowly permeable root zone that restricts the growth of roots and the movement of water. Where irrigation water is of poor quality, salt and toxic elements tend to accumulate in the lower subsoil. This soil extends along the east side of the main valley from Tres Pinos northward to the county line.

This soil is used mostly for irrigated apricots, prunes, pasture, and alfalfa. Irrigated truck and row crops could also be grown. Small grain and pasture are produced without irrigation. Fruit trees are grown more because of the availability of irrigation water and better air drainage than because of soil qualities. Irrigation water, however, is not available in all areas of this soil.

This soil has unstable structure, and it tends to puddle and to turn into powder when it is cultivated. Crop residues, organic matter from any source, grass roots, and infrequent tillage are needed to improve soil structure and infiltration. Although this soil is nearly level, mulches, residues, or close-growing plants are needed for protection against erosion.

In areas not used for orchard, crop rotations are needed for improving soil structure and for avoiding the pests and diseases that are common in a single-crop system. Runoff water from benches can be safely lowered by using overpour structures or diversions. Borders and furrows can be used for irrigation. Sprinklers may be better, however, because they provide better control of water and lessen the danger of temporary waterlogging in this soil with limited storage capacity. Soil leveling that exposes the subsoil or thins the surface layer should be avoided.

Most crops respond favorably to additions of nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IIIs-4 (14)

Soils in this unit are very deep, somewhat excessively drained to well drained, coarse textured to moderately coarse textured, and generally nearly level to moderately sloping. These soils are in the Arnold, Corralitos, and Metz series. The sloping soils are loamy sands, and the nearly level soils are gravelly. In most places these soils are somewhat stratified. Permeability is rapid, and roots readily penetrate to a depth of 60 inches or more. Available water holding capacity is about 4.0 to 5.0 inches.

Reaction range from strongly acid to moderately alkaline. The soils in this unit are similar to those in unit IIs-4 (14) but hold less moisture and in some places are more sloping. Slopes generally range from 0 to 9 percent, and the hazard of erosion is slight to moderate. A small acreage of Arnold loamy sand, 9 to 15 percent slopes, is more sloping than the other soils in this unit, is more limited in use, and needs more intensive management. The soils in this unit occur in the northern half of the county on first bottoms along the main streams in small valleys in the Aromas area.

These soils are used for irrigated walnuts, apricots, and alfalfa. Irrigated truck and row crops are grown on the nearly level soils. Grapes, a few apricots, small grain, and pasture are grown without irrigation. In some areas irrigation water is not available.

Frequent applications of irrigation water are needed on these soils. Surface methods of irrigation can be used if the runs are short so as to avoid loss of water through deep percolation. Contour furrows laid out carefully can be used in sloping areas. Sprinklers, particularly on the more sloping soils, have advantages in reducing percolation losses because the irrigations are easily controlled. Cuts made in soil leveling and smoothing do not expose soil that varies greatly from the original surface layer, though stringers of very gravelly material are exposed in some areas.

Because fertility is low, these soils benefit from crop rotations that provide large amounts of residues and roots. Organic material from any source is also beneficial. The sloping areas need close-growing vegetation, stubble, and other residues during the rainy periods. In orchards and vineyards a cover crop is needed, but under dryland farming growth of this crop needs to be checked in the spring before too much moisture has been used.

For good crop growth under irrigation, careful use of fertilizers is required. All crops except alfalfa respond to nitrogen, all crops including alfalfa respond to phosphorus. Potassium fertilizer may be helpful, particularly on truck crops.

CAPABILITY UNIT IIIs-4 (15)

Soils in this unit are very deep, well-drained and somewhat excessively drained, moderately coarse textured, and nearly level. These soils are in the Hanford and Metz series. Sandy material that is stratified and rapidly permeable is at a variable depth. Roots penetrate to a depth of 60 inches. Available water holding capacity is 5.0 to 8.0 inches.

The Hanford soil is slightly acid and the Metz soil is moderately alkaline and generally calcareous throughout. These soils are similar to the soils in unit IIIc–1 (15). Slopes are 0 to 2 percent, and the hazard of erosion is none to slight.

These soils are used for dryland small grain.

Because fertility and content of organic matter are low, these soils benefit from crop rotations that provide large amounts of residues and roots. Lack of moisture limits the production of crops on these soils, especially in years of unfavorable rainfall. It also limits crop response to additions of fertilizer.

CAPABILITY UNIT IIIc–1 (15)

Soils of this unit are very deep, well drained, moderately coarse textured to moderately fine textured, and commonly nearly level. These soils are in the Botella, Hanford, Mocho, Reiff, Salinas, Sorrento, and Yolo series. Some of the soils in this unit also occur in unit I–1 (14), where irrigation water is available, but some occur only in unit IIIc–1 (15), where irrigation water is not available. In most places permeability ranges from moderately rapid to moderately slow in the subsoil. Roots penetrate to a depth of 60 inches or more. The texture of the surface layer and subsoil generally ranges from sandy loam to clay loam. Available water holding capacity is about 7.5 to 12.0 inches.

The surface layer ranges from medium acid to moderately alkaline. In places the surface layer is calcareous. Lower horizons tend to be more alkaline than the surface layer and in many places are calcareous. Nearly all slopes are less than 2 percent, and the hazard of erosion is none to slight. These soils are limited mainly by lack of moisture in summer and the narrow selection of suitable crops. These soils occur in small valleys throughout the county.

The soils in this unit are used for dryland small grain, sudangrass, pasture, and small areas of beans and dryland apricots. Additional crops can be grown, but they do not grow well and extension of farming is not advisable.

Maintaining soil structure and fertility is important. Crop rotations that provide large amounts of grass roots and other crop residues are needed. Infiltration is increased during the rainy periods by leaving stubble or other organic material on or near the surface. A close-growing crop is useful in protecting the surface. Tillage pans tend to form in some soils of this unit, but they can be partly erased by subsoiling. Compaction is decreased by avoiding working these soils when they are wet. In some places diversions and other control structures may be needed for protection against runoff from adjacent hills. Along some small streams it may be necessary to protect the banks and stabilize the channels.

If rainfall is average or above, crops respond well to nitrogen fertilizer.

CAPABILITY UNIT IVe–1 (15)

Soils of this unit are deep, well drained, moderately coarse textured to medium textured, and strongly sloping. These soils are in the Arguello, Rincon, Shedd, Sheridan, Soper and Vallecitos series. A few small areas have as little as 20 inches of soil above the bedrock; other areas have 48 inches; and some are 60 inches deep over clay. Many of the deep soils have moderately slow to slow permeability in the subsoil. The penetration of roots is restricted to a depth ranging from 20 to 60 inches by a combination of bedrock, subsoil permeability, and lack of deep moisture.

The texture of the surface layer ranges from sandy loam to loam, and some soils are shaly or gravelly. The subsoil of some soils is finer textured than the surface layer and ranges from sandy loam to heavy clay loam. Available water holding capacity ranges from 3.0 to 10.0 inches.

The surface layer is commonly medium acid, but it is slightly acid in some places. It is slightly more acid than the subsoil. One soil is strongly acid, and another has lime throughout the profile. Slopes range from 9 to 15 percent, and erosion is a moderate to severe hazard in unprotected cultivated areas. Lack of moisture in summer is also a hazard. The soils in this unit occur throughout the county on foothills and ridgetops. They are inextensive.

Most of the acreage of these soils is used for dryland pasture along with more extensive areas of range. Small areas are used for small grain and sudangrass.

Pasture plants or other close-growing vegetation is needed in most years so that the content of organic matter is maintained, infiltration is increased, and erosion is controlled. If needed the soils can be tilled 1 year out of 4 to 8, but stubble or a mulch is needed in the tilled areas. Also, tillage should be on the contour. In a few places diversions may be needed to divert runoff from adjacent hills.

In years when rainfall is average or above, crops respond to nitrogen, phosphorus, and sulfur fertilizers.

CAPABILITY UNIT IVe–3 (15)

Soils in this unit have a claypan and are well drained to moderately well drained, moderately coarse textured to moderately fine textured, and gently sloping to strongly sloping. These soils are in the Antioch, Cometa, and Cotati series. Some of them are in unit IIIe–3 (14), where irrigation water is available.

The surface layer of the soils in unit IVe–3 (15) is loam, sandy loam, or clay loam and is favorable for the growth of roots. Very slowly permeable clay occurs at a depth of 10 to 24 inches and severely restricts the development of roots. Available water holding capacity is about 3.0 to 6.0 inches in the root zone. The soil directly above the claypan may be saturated for a week or more following a rainy period.

The surface layer ranges from medium acid to strongly acid. Many of the soils are moderately alkaline deep in the subsoil. Fertility is low to moderate. Slopes range from 2 to 15 percent, and the hazard of erosion is moderate to severe in unprotected cultivated areas. Use of these soils is also limited by lack of rainfall in summer and low water-holding capacity. These soils occur in the northern third of the county.

These soils are used for dryland small grain and pasture.

In most years close-growing plants and crop residues are needed. Tillage can be performed only once in 4 to

8 years without risk of severe loss of soil. If tillage is performed, it should be on the contour. Plant residues should be left on the surface during the rainy periods.

These soils, except in dry years, generally respond to nitrogen, phosphorus, and sulfur fertilizers.

CAPABILITY UNIT IVe-5 (15)

Soils in this unit are moderately deep to deep, well drained to somewhat excessively drained, moderately fine textured to fine textured, and moderately steep. The soils are in the Diablo, Gazos, Linne, Los Gatos, Nacimiento, and San Benito series. Texture ranges from clay loam to clay and in each kind of soil is almost uniform from the surface downward. These soils have moderately slow to slow permeability, but roots penetrate them easily. Available water holding capacity ranges from 4.0 to 10.0 inches for the whole profile.

The surface layer ranges from medium acid to moderately alkaline but is mildly alkaline to moderately alkaline in many of the soils. Some of the soils have a calcareous surface layer. Lower horizons have a range in reaction similar to that of the surface layer. Many of the soils in this unit are moderately alkaline and calcareous in some or all parts of the subsoil. Slopes are between 15 and 30 percent, and the hazard of erosion is severe where the soils are tilled and not protected. Fertility is moderate, but cultivating the clayey soils on moderately steep slopes is difficult. These soils are scattered throughout most of the county, where they occur on foothills and broad ridges.

Many of the soils are used for dryland pasture, along with adjacent extensive areas of rangeland. Small grain and sudangrass are grown in some areas. Other crops are grown in small areas that are parts of larger fields consisting of less sloping soils.

These soils need the protection of close-growing vegetation and plant residues most of the time. If crop residues are used and soil structure is maintained, tilled crops can be grown about 1 year out of 4 to 8. Also, these soils can be kept in continuous cover such as pasture. Tillage should be on the contour, and part of the plant remains should be left on the surface for protection against erosion.

Plants respond favorably to nitrogen fertilizer in years of average or above average rainfall. The response to phosphorus and sulfur fertilizers depends on local variations of the soil and the amount of rainfall.

CAPABILITY UNIT IVw-6 (14)

Soils in this unit occur in basins and are poorly drained, fine textured, and nearly level. They are in the Willows series. Although these soils are deep, roots of most crops generally do not extend below a depth of 24 to 36 inches. The surface layer is clay in most places, though it is clay loam in sizable areas that have an uneven, scoured surface. Lower horizons are clay loam to clay in which the amount of clay increases with increasing depth. Permeability ranges from moderately slow to slow. During most winters a water table commonly occurs about 30 inches below the surface. Available water holding capacity is about 7.0 to 9.0 inches for the entire root zone.

The surface layer is mildly alkaline to strongly alkaline. The surface layer is calcareous in some places, but the lower horizons are calcareous in almost all places. In addition, these soils are moderately saline to strongly saline, though concentration of salt is somewhat spotty. The hazard of erosion is none to slight, and there is a small risk of flooding and scouring. These soils occur in the Bolsa area.

Most of the acreage of these soils is used for pasture and range, but a few areas are used for alfalfa hay and row crops, primarily sugar beets. Some of the cropped areas are parts of larger fields consisting of better soils. These soils are suitable for irrigated pasture, alfalfa, and a few salt-tolerant crops, such as sugar beets or barley.

Where soils are to be used for pasture or for irrigated crops, drainage and the reduction of salt and alkali are needed. Reclamation may not be practical, however, because permeability is slow, drainage outlets are not readily available, and irrigation water is not abundant. For substantial improvements, these soils should be drained by a well laid out system and then leached of salt. Unless these soils are drained, the applications of irrigation water must be small so that the water table does not rise and cause accumulation of salt at or near the surface. Leaching of salt from the surface layer is essential. Drains that are at least shallow are needed for removal of tail water. In some areas dikes or enlarged channels are needed to prevent flooding and scouring. Where there are no flood control structures, a strong turf helps to control the loss of soil.

Benefits from fertilizer are low unless salt has been removed and other improvements made. Organic material spread on or mixed into the soil aids reclamation and helps to improve tilth and permeability. On improved soils, most field crops respond to nitrogen and alfalfa responds to phosphorus.

CAPABILITY UNIT IVc-1 (15)

Soils in this unit are moderately deep to very deep, well drained, medium textured to moderately fine textured, and nearly level to moderately sloping. These soils are in the Docas series. They have a silt loam or clay loam surface layer and a subsoil of about the same texture as the surface layer. They contain fairly large amounts of silt. Depth of these soils is more than 60 inches. Roots readily penetrate all of the soil, though lack of moisture deep in the profile makes the total soil depth unimportant. Permeability is moderate. Available water holding capacity is about 10.0 to 12.0 inches.

These soils are moderately alkaline and calcareous throughout. They are not saline. Slopes range from 0 to 9 percent, and the hazard of erosion is generally none to slight, though infrequently an intense storm may damage tilled soils that are bare. Average rainfall is only about 10 to 14 inches, and irrigation water is not available. These soils occur near the southeastern edge of the county.

These soils are used for dryland small grains and pasture. Lack of precipitation limits the choice of crops. A common practice is to alternate a year of fallow with a year of small grain. Soils used for grain should be tilled on the contour. Part of the stubble should be left on this soil so as to protect it against erosion. The use of fertilizer is not practical, because sufficient moisture is lacking.

CAPABILITY UNIT VIe-1 (15)

Soils in this unit are shallow to moderately deep, well drained to somewhat excessively drained, moderately coarse textured to moderately fine textured, and moderately steep to steep. The soils are in the Auberry, Gaviota, Kettleman, Pinto, Santa Lucia, Shedd, Soper, and Vallecitos series. Terrace escarpments, a land type, is also in this unit. These soils have a sandy loam to clay loam surface layer. They are shaly or gravelly in places. The subsoil is similar to the surface layer or is clay loam. A large proportion of the soils are 20 to 30 inches deep over bedrock or a hardpan. A few are less than 20 inches deep, and others are deeper than 36 inches. The subsoil generally is moderate to slow in permeability. Available water holding capacity is 2.0 to 10.0 inches.

Nearly all of the soils in this unit are medium acid to moderately alkaline throughout, although two soils are calcareous throughout. Most soils receive an average annual precipitation of 12 inches. The more shallow and erodible soils are on slopes of 15 to 30 percent, but slopes are as much as 30 to 50 percent in some places and as little as 2 to 15 percent in other places. The hazard of erosion is severe. Many of the soils in this unit occur in the northern part of the county, but some are scattered in hilly areas in other parts.

These soils are used mostly for dryland pasture. Close-growing crops and plant residue are needed for protection against erosion. Tillage needed for seeding and brush control can be carried out in many small areas, though operation of farm equipment is difficult. Pasture plants respond favorably to nitrogen, phosphorus, and sulfur fertilizers.

CAPABILITY UNIT VIe-3 (15)

Soils in this unit have a very slowly permeable claypan and are moderately well drained to well drained, moderately coarse textured or medium textured, and strongly sloping to moderately steep. These soils are in the Cotati and Pinnacles series. Their surface layer is coarse sandy loam or loam that is easily penetrated by water. The subsoil is at a depth of 16 to 48 inches and consists of clay or sandy clay. The growth of roots is severely restricted by the clay in the subsoil. Total available water holding capacity is 2.5 to 6.0 inches of water.

Reaction generally ranges from medium acid to strongly acid in both the surface layer and the subsoil. Fertility is low. Most slopes are 15 to 30 percent, and a few are 9 to 15 percent. The hazard of erosion is moderate or severe. In these soils small amounts of runoff cut deep gullies that discourage tillage. Also, working these soils on the moderately steep slopes is difficult. These soils are inextensive in this county. They occur in the northwestern and southwestern parts in areas of fairly low hills.

These soils are used for pasture. They need protection of continuous vegetation and are not suited to tilled crops. If plant residues are left near the surface, the tillage needed for seeding and for brush control can be carried out. Plants respond to nitrogen, phosphorus, and sulfur fertilizers, but it is uncertain whether fertilization is economically feasible.

CAPABILITY UNIT VIe-4 (15)

Soils in this unit are moderately deep to deep, well drained to somewhat excessively drained, coarse textured to moderately coarse textured, and moderately steep. These soils are in the Arnold and Sheridan series. They have a coarse sandy loam or loamy sand surface layer, and there is little difference in texture between the surface layer and subsoil. Roots easily penetrate these soils, but their growth is severely limited by the decomposed granite or soft sandstone, which is at a depth ranging from 30 to 48 inches. Permeability is moderately rapid to rapid. Available water holding capacity is about 3.0 to 7.0 inches.

These soils are generally about medium acid, but they range from slightly acid to strongly acid. Slopes range from 15 to 30 percent, and the hazard of erosion is moderate to severe. These soils occur along the northwestern boundary of the county.

Pasture is the main use of these soils. Small areas were cultivated, but tillage is limited by the steep slopes. Trees and brush grow in small areas and limit grazing. If care is used, enough tillage can be carried out for seeding forage plants or controlling brush, but these soils need the protection of continuous vegetation and a moderate amount of plant residues.

Favorable response to nitrogen fertilizer is obtained in years when rainfall is above average. Response to fertilizers, however, is not so favorable as for soils in unit VIe-1 (15) and is not nearly so favorable as for the soils in unit VIe-5 (15).

CAPABILITY UNIT VIe-5 (15)

Soils in this unit are moderately deep to deep, well drained, fine textured to moderately fine textured, and moderately steep to steep. These soils are in the Climara, Diablo, Gazos, Linne, Los Gatos, Nacimiento, and San Benito series. Texture is commonly clay loam, but it is clay in some areas. Bedrock is at a depth of 24 to 48 inches, and it limits the penetration of roots. Available water holding capacity is about 3.0 to 8.0 inches.

The surface layer ranges from medium acid to moderately alkaline but is neutral or alkaline in more than half of the acreage. Many of the soils are alkaline and calcareous in the lower part of the profile. Fertility is fairly high. Average annual rainfall is more than 10 inches. Most soils have slopes ranging from 30 to 50 percent, but a few have slopes of 15 to 50 percent. The hazard of erosion is moderate to high. The soils in this unit are extensive in this county and are scattered throughout the hilly areas.

These soils are used for pasture. They require the protection of close-growing plants. The best protection is provided by pasture grasses, forbs, and fairly large amounts of residues. If cultivation is practiced for forage improvement, large amounts of plant residues should be left on and near the surface. Tillage should be performed on the contour and in a way that disturbs these soils very little. Crop response to nitrogen, phosphorus, and sulfur fertilizers is favorable.

CAPABILITY UNIT VIs-5 (15)

Soils in this unit are moderately deep, well drained, stony and rocky, fine textured to medium textured, and moderately steep to steep. These soils are in the Cibo, Los Gatos, Sween, and Vallecitos series. They have a clay, clay loam, or loam surface layer and a similar or finetextured subsoil. Bedrock is at a depth of 50 inches, and it limits the penetration of roots. Available water holding capacity is about 3.0 to 6.0 inches.

Reaction ranges from medium acid to neutral in the surface layer and from neutral to mildly alkaline in the lower part. Except for the material in a few rock joints, these soils are not calcareous. Fertility is moderate. Average annual rainfall is about 14 to 20 inches. Slopes range from 9 to 50 percent, and the hazard of erosion is moderate to severe. These soils occur mainly in the northeastern part of the county, but small areas are in the northwestern and central parts.

These soils are not suited to cultivated crops, and they are used for pasture. They need the protection of close-growing plants. Pasture grasses, forbs, and a fairly large amount of plant residue provide the best protection. Rocks are not numerous enough to prevent limited tillage in most places. If cultivation is a part of forage improvement, large amounts of plant residues should be left on and near the surface. Such tillage should be on the contour and should be done in a manner in which the soils are disturbed or compacted very little. Favorable response to nitrogen, phosphorus, and sulfur fertilizers can be anticipated.

CAPABILITY UNIT VIIe-1 (15)

Soils in this unit are shallow to moderately deep, well drained to somewhat excessively drained, moderately fine textured to moderately coarse textured, and steep to very steep. These soils are in the Auberry, Gaviota, Henneke, Kettleman, Lodo, Los Banos, Pinnacles, Santa Lucia, Shedd, Soper, and Vallecitos series. Gullied land, a land type, is also in this unit. The surface layer of these soils is loam in most places, but there are small areas that have a sandy loam or fine sandy loam surface layer and a clay loam or sandy clay subsoil. Some soils are eroded, and the subsoil material is exposed. These soils are generally 15 to 40 inches deep, but in places they are as shallow as 10 inches or as deep as 60 inches. Available water holding capacity is 1.0 to 8.0 inches for the whole soil profile.

These soils are medium acid to moderately alkaline in both the surface layer and subsoil, but the range in reaction is not so wide in any one kind of soil. Average annual rainfall is generally more than 10 inches but may be as low as 6 inches. Slopes generally range from 30 to 50 percent, but some are as much as 75 percent or as little as 5 percent. The erosion hazard is severe. The soils in this unit are extensive and occur throughout the county.

These soils are unsuitable for cultivation. They are used as range. In some areas the amount of usable forage is limited by brush. It is essential that these soils are protected at all times by a good cover of plants and plant residues. Seeding and fertilizing are so difficult that their expense cannot be justified.

CAPABILITY UNIT VIIe-4 (15)

Soils in this unit are shallow to deep, well drained to excessively drained, coarse textured to moderately coarse textured, and steep to very steep. These soils are in the Arnold, Cieneba, Laniger, and Sheridan series. Most of the soils have a coarse sandy loam or gravelly sandy loam surface layer. The subsoil has the same texture as the surface layer. Extensive areas are 18 to 30 inches deep over granite. Some soils on sediments are deeper, but few roots can penetrate the dense subsoil. Arnold loamy sand, 30 to 50 percent slopes, severely eroded, is loamy sand throughout and is 30 inches or more deep, but it is not extensive. Most of the soils have rapid to moderately rapid permeability. Total available water holding capacity is about 1.5 to 5.0 inches.

Reaction is medium to strongly acid. Average annual precipitation is 14 to 25 inches. Slopes range from 30 to 75 percent, and the hazard of erosion is severe. The soils of this unit occur along the western boundary of the county. They are moderately extensive.

Range is the main use, but brush covers extensive areas and reduces the forage available. The protection of vegetation and plant residues is needed at all times. Seeding and fertilization are so difficult, and they improve the range so little, that they are not practiced except after fires, and then for the purpose of protecting soils downslope.

CAPABILITY UNIT VIIe-5 (15)

Soils in this unit are shallow to moderately deep, well drained, fine textured to moderately fine textured, and steep to very steep. These soils are in the Diablo, Gazos, Linne, Nacimiento, and San Benito series. Landslides, a land type, is also in this unit. These soils have a clay loam or clay surface layer and a subsoil of about the same texture as the surface layer. They are only 20 to 36 inches deep. Available water holding capacity is about 3.0 to 6.0 inches.

Most soils in this unit are neutral to moderately alkaline, but one is slightly acid to medium acid. Average annual rainfall is more than 10 inches. Many slopes are between 50 and 75 percent, though some severely eroded areas are not so steep. The hazard of erosion is severe to very severe. These soils are scattered throughout the county.

These soils are used as range. A vegetative cover is needed at all times. Plant growth is fair, but most of the vegetation should be left so as to protect the soils and encourage new plant growth. Heavy stands of brush are not common. Slopes are too steep or the surface is too rough for seeding and fertilizing.

CAPABILITY UNIT VIIw-4 (14)

Only Sandy alluvial land is in this capability unit. It occurs on flood plains and is very deep, coarse textured, and nearly level. The soil material ranges from coarse sand to sandy loam and is gravelly and stratified in most places. Roots normally penetrate deeply, except in some areas where the strata are too coarse and too droughty for root development. Generally, the soil material is very rapidly permeable and excessively drained. During winter and spring some part of the soil profile may be saturated. Flooding, scouring, and deposition of fresh material is likely. Available water holding capacity is about 4.0 to 6.0 inches. Most slopes are less than 2 percent, but a few are not so nearly level.

Reaction is slightly acid to mildly alkaline. This land is scattered along the main streams throughout the county.

Sandy alluvial land is used for limited grazing, but the amount of forage is limited. The land is covered with brush, willows, and annuals in many places, and many areas have bare streaks. Seeding, fertilizing, or clearing brush for the purpose of improving the forage is not profitable. It may be necessary, however, to straighten channels, clear brush, or stabilize streambanks so as to protect more valuable adjacent land.

CAPABILITY UNIT VIIs-1 (15)

Soils in this unit are rocky and stony, well drained to somewhat excessively drained, medium textured to fine textured, and moderately steep to very steep. These soils are in the Cibo, Gaviota, Sween, and Vallecitos series. The surface layer is loam, clay loam, and clay, and the subsoil of the loam and clay loam soils is finer textured than the surface layer. Most soils are 10 to 20 inches deep over bedrock, but some are more than 30 inches. Total available water holding capacity is 2 to 4 inches of water.

Reaction ranges from neutral to medium acid. Slopes range from 15 to 75 percent, but they are between 30 and 50 percent in extensive areas. The hazard of erosion is moderate to very severe. The soils in this unit occur throughout the county, particularly in the eastern part. They are extensive.

These soils are used for range. A good cover of plants and plant residues is needed at all times for protection against erosion. Because of the rocks, steep slopes, or other unfavorable soil features, seeding and the clearing of brush are not practical.

CAPABILITY UNIT VIIs-9 (15)

Soils in this unit are very shallow or are rocky. They are well drained to somewhat excessively drained, medium textured to moderately fine textured, and moderately steep to very steep. These soils are in the Montara series. Their surface layer and subsoil are silty clay loam. Depth of these soils ranges from 4 to 20 inches. Rock outcrops or stones cover from 2 to 10 percent of the surface. These soils developed on serpentine rocks and generally are deficient in calcium. Permeability is moderately slow. Available water holding capacity for the profile is about 1.0 to 3.0 inches.

Reaction is generally slightly acid to mildly alkaline, but in a few places it is moderately alkaline, particularly in the lower part of the profile. Slopes range from 15 to 50 percent, and the hazard of erosion is generally severe. These soils are in scattered areas in the northeastern and southeastern parts of the county. They are more extensive in the southeastern part.

Use of these soils is limited by steep slopes, shallowness, rockiness, low fertility, and erosion. The main use is limited grazing. A large part of the forage produced on the soils of this unit should be left to protect the soil and to encourage the regrowth of plants.

CAPABILITY UNIT VIIc-1 (15)

Soils in this unit are very deep, well drained, moderately coarse textured to medium textured, and nearly level to moderately sloping. These soils are in the Panhill and Panoche series. They have a loam or sandy loam surface layer. In most places roots readily penetrate to a depth of 60 inches or more, though moisture is not available so deep in the profile. Permeability is moderate to moderately rapid. Average annual rainfall is 5 to 10 inches. Available water holding capacity is 8.0 to 11.0 inches. The low annual rainfall limits use of these soils more than does the available water holding capacity.

Most of the soils are moderately alkaline and calcareous throughout. The soils are not saline. Slopes range from 0 to 9 percent, and the hazard of erosion is none to slight. The soils in this unit occur in or near Panoche Valley, near the eastern boundary of the county.

These soils are used for range. Some plant residues should be left on the surface to encourage plant growth the following year. Cost of improving the growth and quality of the forage plants through reseeding and fertilization is not justified at this time.

CAPABILITY UNIT VIIIe-1 (15)

This unit consists of shallow, steep and very steep, severely eroded soils. These soils are in the Nacimiento series. Badland, a land type, is also in this unit. The soils in the unit are less than 20 inches deep. Little water penetrates the soil material, because the surface seals and crusts. Nearly all of the rainfall runs off, and it takes much soil material with it. Hard bedrock does not occur. Slopes are 45 to 60 percent or more. Many areas are bare, and only thin, brushy stands cover other areas.

These soils have no use for farming. Reclamation is not feasible, but structures and planting may be needed for protection against gullying and sloughing and to prevent soil material from being deposited on lower areas. Much soil material is washed away and deposited. The plant cover on these soils should be protected and encouraged.

CAPABILITY UNIT VIIIw-4 (14)

Only Riverwash is in this unit. It consists of sand and gravel in channels of the larger streams. The soil material is excessively drained, though this land is commonly flooded part of the year. Sorting, scouring, and redeposition of soil material are likely. The surface is free of vegetation or is sparsely covered by annuals, brush, and willows that may be removed when the flow of the streams is heavy.

This land has essentially no value for vegetation, but it is valuable as infiltration beds and for storing underground water. Also, Riverwash is used for commercial sand and gravel. Adjacent land would benefit if channels were alined and the streambanks protected.

CAPABILITY UNIT VIIIs-1 (15)

The soils and land types in this unit are very shallow to shallow, rocky, and moderately steep to steep. The soils are in the Cieneba and Henneke series, and the land types are Igneous rock land, Sedimentary rock land, and Mine pits and dumps. The soil material normally is less than 10 inches deep. Rock outcrops generally cover from 35 to 90 percent of the surface. Texture is variable but normally ranges from coarse sandy loam to loam. Many rock fragments are in the soil material. Available water holding capacity totals 1.0 to 4.0 inches. Slopes range from 15 to 75 percent, and many areas are eroded. The hazard of further erosion is very severe. Runoff is medium to very rapid. The vegetation varies. In some places there is a brushy cover that ranges from dense and high to sparse and low. Other areas have a thin cover of grass, and some areas are bare.

These soils and land types have no value for farming. They are used mainly as wildlife habitat, and their vegetation should be protected. Special measures may be needed on the watershed above to protect low areas. The main management needed is protection from fires.

Estimated Yields and Soil Management Practices

This section presents estimated yields of the principal crops grown in the county and some of the management practices used to obtain those yields. Yields are listed in table 2 for alfalfa, apricots, grapes, prunes, sugar beets, tomatoes, walnuts, and barley. These estimates are based on observations made by the soil scientists who surveyed the county, on information furnished by farmers, and on data from the Agricultural Extension Service, Soil Conservation Service, California Agricultural Experiment Station, and the San Benito County Agricultural Commissioner. For crops on some soils detailed information was available. If little information was available about the yield on a particular kind of soil, estimates were made by comparing that soil with similar soils. Only those soils that are widely used for crops are listed in table 2.

The yields in table 2 are averages, and in any one year actual yields may be higher or lower than those listed. Also, the yields do not apply to individual parcels of land, and in San Benito County the weather has a great effect on yields.

Estimates of yields are of most use when the management practices under which yields can be produced are specified. The combination of practices needed for producing the yields given in table 2 are for the best known management, or the level of management that experience, field trials, and research findings indicate give the highest returns at the present time.

This information on yields and management practices will be most useful immediately after the release of this survey. New developments in crop breeding, in control of insects and diseases, and in use of fertilizer, tillage, irrigation, and drainage may replace much of the information in this section. The latest information can be obtained from State and Federal publications or agricultural agencies.

The management commonly practiced for most crops grown in San Benito County includes proper preparation of the seedbed and control of insects and weeds. Under an optimum level of management, the best adapted and most desirable known varieties of crops are grown and planting, harvesting, pruning, tillage, irrigation, and other management are performed at the proper time or season. Management by capability units is discussed in the section "Capability Groups of Soils."

Given in the following paragraphs are the cropping sequence, rates of planting and fertilization, and amounts of irrigation water that were assumed when the yields for the crops specified in table 2 were estimated.

Alfalfa.—A typical cropping sequence consists of 4 years of alfalfa followed by 2 to 3 years of selected row or field crops. The alfalfa seed is inoculated prior to seeding and is drilled at a rate of 5 to 7 pounds per acre. In the summer or in fall following planting, 40 pounds of phosphorus is applied. Alfalfa requires 3 acre-feet of irrigation water per acre annually on loamy and clayey soils and as much as 4.5 acre-feet per acre annually on the sandy soils.

TABLE 2.—*Estimated average yields per acre of principal irrigated and dryland crops*

[Absence of yield figure indicates that the soil is not suited to the crop specified or that the crop is not commonly grown]

Soil	Irrigated crops							Dryland crop
	Alfalfa	Apricots	Grapes	Prunes	Sugar beets	Tomatoes	Walnuts	Barley
	Tons	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*100 lbs.*
Antioch clay loam, 9 to 15 percent slopes, eroded			1. 5					16
Antioch loam, 0 to 2 percent slopes		4	2	1				20
Antioch loam, 2 to 5 percent slopes		4	2	1				18
Antioch loam, 5 to 9 percent slopes, eroded		3. 5	2	1				16
Arguello loam, 2 to 9 percent slopes								26
Arguello shaly loam, 9 to 15 percent slopes								22
Botella loam, 0 to 2 percent slopes								35
Botella loam, 2 to 9 percent slopes								35
Clear Lake clay	7	6		1. 5	30	35	1. 1	22
Clear Lake clay, saline	5				25	20		18
Clear Lake silty clay loam								25
Cometa loam, 5 to 15 percent slopes, eroded								18
Cometa sandy loam, 5 to 15 percent slopes, eroded								18
Conejo clay loam, 2 to 9 percent slopes								35
Corralitos loamy sand, 2 to 9 percent slopes		6	4					16
Cropley clay, 0 to 2 percent slopes	7	5	4		30	35	1. 2	30
Cropley clay, 2 to 9 percent slopes	7	5	4		30	30	1. 2	24
Cropley silty clay loam, 2 to 9 percent slopes	7	5	4		30	30	1. 3	24
Diablo clay, 9 to 15 percent slopes								26
Diablo clay, 15 to 30 percent slopes, eroded								20
Diablo-Linne complex, 9 to 15 percent slopes								18
Diablo-Linne complex, 15 to 30 percent slopes, eroded								16
Edenvale clay, 0 to 2 percent slopes								26
Gazos silty clay loam, 9 to 15 percent slopes								16

TABLE 2.—*Estimated average yields per acre of principal irrigated and dryland crops*—Continued

Soil	Irrigated crops							Dryland crop
	Alfalfa	Apricots	Grapes	Prunes	Sugar beets	Tomatoes	Walnuts	Barley
	Tons	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*100 lbs.*
Hanford coarse sandy loam, 0 to 2 percent slopes	6	----	5	----	24	25	1. 1	20
Hanford coarse sandy loam, 2 to 9 percent slopes	6	----	5	----	22	20	1. 1	20
Hanford loam, 0 to 2 percent slopes	7	----	5	----	28	30	1. 4	28
Hanford loam, 2 to 9 percent slopes	7	----	5	----	28	30	1. 4	26
Linne clay loam, 9 to 15 percent slopes	----	----	----	----	----	----	----	24
Linne clay loam, 15 to 30 percent slopes, eroded	----	----	----	----	----	----	----	22
Los Gatos clay loam, 15 to 30 percent slopes	----	----	----	----	----	----	----	20
Metz gravelly sandy loam, 0 to 2 percent slopes	6	5	4	1. 5	24	30	1. 1	16
Metz gravelly sandy loam, 2 to 9 percent slopes	6	5	4	----	24	30	1. 1	16
Metz sandy loam, 0 to 2 percent slopes	6	6	5	1. 5	28	30	1. 2	18
Metz sandy loam, wet variant, 0 to 2 percent slopes	6	----	4	----	28	30	. 9	----
Mocho clay loam, 2 to 9 percent slopes	7	7	5	2. 5	25	32	1. 9	35
Mocho gravelly loam, 2 to 5 percent slopes	7	7	5	2. 2	33	30	1. 9	30
Mocho loam, 0 to 2 percent slopes	7	8	5	2. 5	33	35	2. 0	30
Mocho loam, 2 to 9 percent slopes	7	8	5	2. 5	33	32	1. 9	30
Mocho sandy loam, 0 to 2 percent slopes	7	8	5	2	30	32	1. 9	24
Mocho sandy loam, 2 to 9 percent slopes	7	8	5	2	30	30	1. 9	22
Nacimiento clay loam, 9 to 15 percent slopes	----	----	----	----	----	----	----	24
Pacheco clay loam over clay	6	5	----	1. 7	25	20	1. 2	18
Pacheco loam	7	6	4	----	33	35	1. 5	24
Pacheco silt loam	7	6	4	----	33	35	1. 5	24
Pacheco silty clay	7	7	5	2	33	35	1. 5	35
Panoche loam, 0 to 2 percent slopes	7	----	----	----	----	----	----	[1] 35
Panoche loam, 2 to 9 percent slopes	7	----	----	----	----	----	----	[1] 35
Panoche sandy loam, 0 to 2 percent slopes	7	----	----	----	----	----	----	[1] 30
Panoche sandy loam, 2 to 9 percent slopes	7	----	----	----	----	----	----	[1] 30
Pleasanton gravelly loam, 5 to 9 percent slopes, eroded	----	----	----	----	----	----	----	18
Pleasanton loam, 2 to 5 percent slopes	----	----	3	----	----	----	----	20
Reiff sandy loam, 0 to 2 percent slopes	7	7	5	1. 8	28	30	1. 7	22
Reiff sandy loam, 2 to 9 percent slopes	7	7	5	1. 8	28	28	1. 7	20
Rincon loam, 0 to 2 percent slopes	5	5	4	1. 4	25	20	1. 3	27
Rincon loam, 2 to 9 percent slopes	5	5	4	1. 4	----	----	1. 3	22
Rincon loam, 9 to 15 percent slopes, eroded	----	----	----	----	----	----	----	18
Rincon silty clay loam, 0 to 2 percent slopes	6	6	4	1. 7	30	30	1. 3	27
Rincon silty clay loam, 2 to 9 percent slopes	5	5	4	1. 5	----	----	1. 3	22
Rincon silty clay loam, 9 to 15 percent slopes, eroded	----	----	----	----	----	----	1. 2	21
Salinas clay loam, 0 to 2 percent slopes	7	9	5	----	33	35	2. 0	36
Salinas clay loam, 2 to 9 percent slopes	7	8	5	----	33	35	2. 0	36
San Benito clay loam, 9 to 15 percent slopes	----	----	----	----	----	----	----	22
Shedd loam, 9 to 15 percent slopes	----	----	----	----	----	----	----	18
Soper gravelly loam, 9 to 15 percent slopes	----	----	----	----	----	----	----	16
Soper gravelly loam, 15 to 30 percent slopes, eroded	----	----	----	----	----	----	----	14
Soper sandy loam, 9 to 15 percent slopes	----	----	----	----	----	----	----	14
Soper sandy loam, 15 to 30 percent slopes, eroded	----	----	----	----	----	----	----	14
Sorrento gravelly loam, 0 to 5 percent slopes	7	7	5	2. 5	30	32	2	32
Sorrento silt loam, 0 to 2 percent slopes	7	8	5	2. 5	33	35	2	35
Sorrento silt loam, 2 to 9 percent slopes	7	8	5	2. 5	33	32	2	35
Sorrento silty clay loam, 0 to 2 percent slopes	7	9	5	2. 5	33	35	2	36
Sorrento silty clay loam, 2 to 9 percent slopes	7	8	5	2. 5	33	32	2	36
Willows clay	----	----	----	----	25	----	----	20
Willows sandy loam	----	----	----	----	25	----	----	20
Yolo gravelly loam, 0 to 5 percent slopes	----	----	----	----	----	----	----	20
Yolo loam, 0 to 2 percent slopes	----	----	----	----	----	----	----	32
Yolo loam, 2 to 9 percent slopes	----	----	----	----	----	----	----	30

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[1] Grown under irrigation.

Apricots.—These trees (fig. 14) require 40 pounds of nitrogen and 40 pounds of phosphorus per acre annually. For a cover crop on sloping soils, 30 pounds of barley seed and 20 pounds of purple vetch seed or 80 pounds of horsebeans should be planted. Apricots require from 25 to 30 acre-inches of irrigation water per acre applied in two to four applications prior to harvest and one or two applications after harvest.

Wine grapes.—These grapes require 40 to 60 pounds of nitrogen per acre annually. For a cover crop that reduces soil blowing and water erosion, adapted bromegrass is drilled in the middle of rows at a rate of 8 pounds per acre. Grapes need 6 to 12 acre-inches of irrigation water per acre annually. Prunings from grape vines annually are shredded and disked into the soil in alternate rows.

Prunes.—Prune trees require 60 to 100 pounds of nitrogen per acre annually and, on some soils, as much as 60 pounds of potassium. For winter cover, 20 pounds of purple vetch, 80 pounds of horsebeans, or 30 to 60 pounds of barley is planted on the sloping soils. Prunes need 24 to 36 acre-inches of irrigation water per acre annually. Irrigation water is applied three to four times before harvest and one to two times after harvest to help establish the cover crop.

Sugar beets.—A typical cropping sequence on the loamy and sandy soils consists of sugar beets for 1 year, truck or field crops for 1 year, and alfalfa for 3 years. On clayey soils, sugar beets, tomatoes, and small grain each are grown for 1 year. Sometimes corn is grown for silage for 1 year. Sugar beets require 120 to 150 pounds of nitrogen per acre per year. In addition, 30 to 40 pounds of phosphorus per acre is needed on sandy soils. For improving structure and tilth on clayey soils, 5 to 10 tons of barnyard manure is needed annually. Sugar beets seasonally require 2 to 3 acre-feet of irrigation water per acre. Crop residues are returned to the soil.

Tomatoes.—A typical cropping sequence consists of tomatoes grown for 2 years and alfalfa grown for 4 years. Another suitable sequence is tomatoes, some other truck crop, and a green-manure crop each grown for 1 year. Coated and treated seed is planted direct. Tomatoes should be fertilized according to the individual needs of the soil and plants as indicated by chemical analyses. In San Benito County, however, tomatoes generally need 40 to 80 pounds of nitrogen and 40 pounds of phosphorus per acre per year. Potassium may also be needed on some soils. Tomatoes need 2 to 3 acre-feet of irrigation water per acre annually. Crop residues are returned to the soil.

Walnuts.—These trees require 100 to 150 pounds of nitrogen per acre annually, applied in two separate applications. For winter cover crop, 20 pounds of purple vetch, 80 pounds of horsebeans, or 40 pounds of barley per acre is needed on sloping soils. Walnuts require 30 to 40 acre-inches of irrigation water per acre annually. At least one application is after harvest.

Barley (dryland).—A cropping sequence consists of barley planted and harvested 1 year, and the volunteer growth grazed for 1 or 2 years, and fallow for 1 year. Seeding is at a rate of 60 to 100 pounds per acre using seed that has been treated with a fungicide. About 30 to 50 pounds of nitrogen is required, but this may not be effective in years of low rainfall. Crop residues are returned to the soil, and a stubble mulch is left at or near the surface.

Barley (irrigated).—A typical sequence consists of barley grown for 1 year, alfalfa for 4 years, and cotton or safflower grown for 1 or 2 years. Another common cropping sequence is barley grown for 1 year and cotton for 1 year. After treatment with a fungicide, the seed is planted at a rate of 60 to 100 pounds per acre. About 60 to 80 pounds of nitrogen per acre is required per year. The soil should be irrigated to a depth of 3 feet just before planting. During the growing season 12 to 18 acre-inches of irrigation water per acre are needed. Crop residues are returned to the soil, and a mulch of stubble is left at or near the surface.

Storie Index Rating[2]

In table 3 the soils of the county are listed in alphabetic order of the soil name and are rated according to the Storie index (*6*). This index expresses numerically the relative degree of suitability, or value, of a soil for general intensive agriculture. The rating is based on soil characteristics only. It does not take into account other factors, such as availability of water for irrigation, climate, and distance from markets, which might determine the desirability of growing specific crops in a given locality. For these reasons, the index, in itself, cannot be considered an index for land valuation.

Four factors that represent the inherent characteristics and qualities of the soils are considered in the index rating. Each factor is rated or evaluated separately in terms of percentage of the ideal, or 100 percent. The factors are—

Factor A, Profile characteristics.—Factor A expresses relative suitability of a soil profile for the growth of plant roots. Soils that have deep permeable profiles are rated 100 percent. Those that have a dense clay layer or a hardpan or are shallow over bedrock are rated less than 100 percent. The rating depends on the extent to which root penetration is limited.

Factor B, Texture of the surface soil.—Factor B is rated according to the texture of the surface soil, which affects the ease of tillage and the capacity of the soil to hold water. The moderately coarse and medium textures—fine sandy loam, loam, and silt loam—are the most desirable and are rated as 100 percent. The coarser and finer textures, such as sand and clay, are rated less than 100 percent.

Factor C, Slope.—Factor C is particularly important if the soil is irrigated. The amount of water that runs off a soil and its susceptibility to erosion are influenced by the slope of the soil. Smooth, nearly level or very gently sloping soils are rated 100 percent. The rating decreases as the slope increases.

Factor X, Other conditions.—Factor X is used to evaluate any other limitations to use of the soil, such as poor drainage or a high water table, erosion, salts or alkali, low fertility, acidity, or unfavorable microrelief. If more than one limitation exists, the values of each are multiplied together to get the X factor. The index rating of a soil is obtained by multiplying the four factors A, B, C, and X; thus, any one factor may dominate or control the final rating. For example, a soil may have an excellent

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[2] Ratings by EUGENE L. BEGG, soil specialist, University of California.

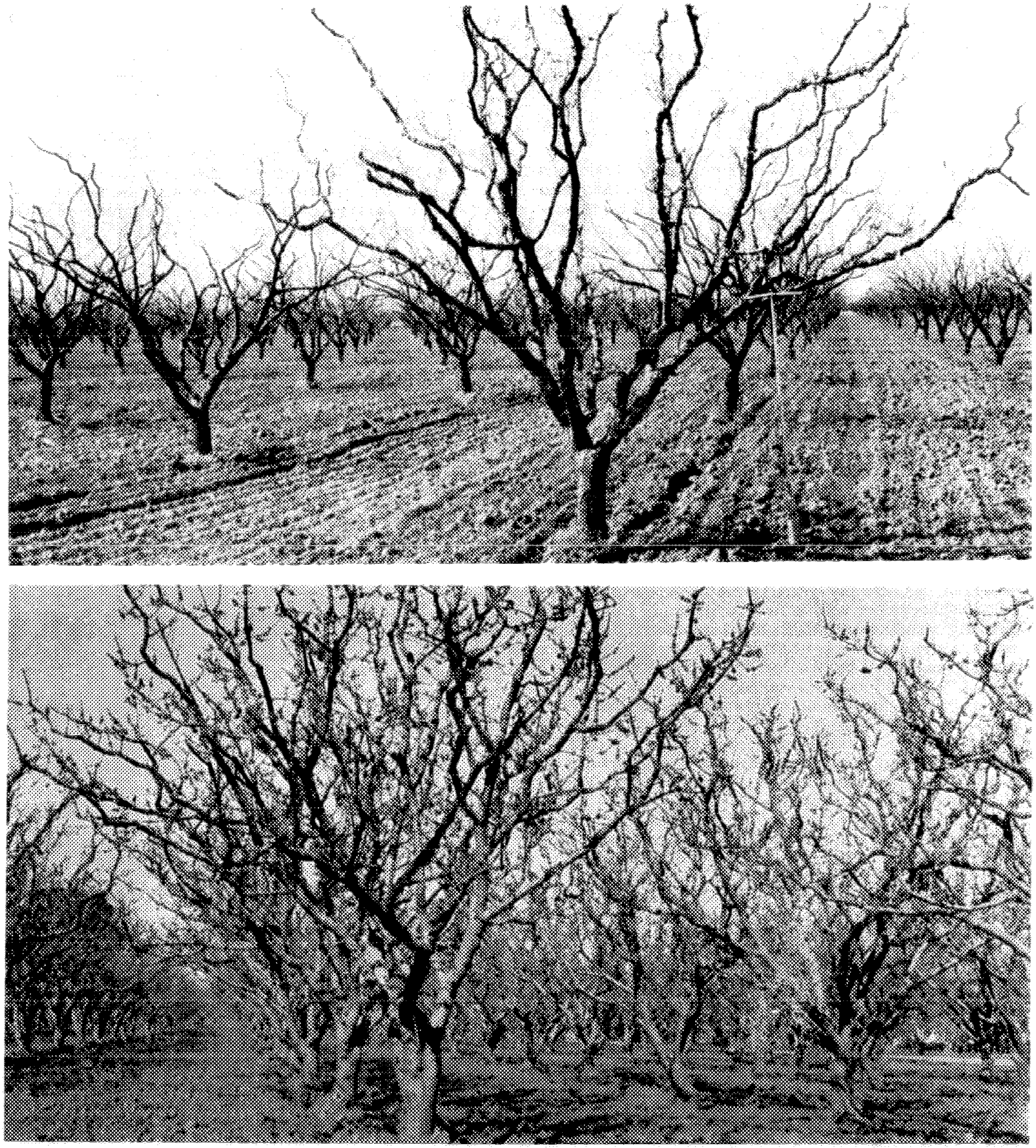

Figure 14.—Mature apricot trees. *Top,* trees on Antioch loam, 0 to 2 percent slopes, are small thinly branched, and only moderately productive (Auger is about 5 feet long). ***Bottom,*** even, healthy, well-branched trees on Sorrento silt loam, 0 to 2 percent slopes. They produce an above average amount of high-quality fruit.

TABLE 3.—*Storie index rating for soils of San Benito County*

[Limitations used in computing the X factor for some of the soils are indicated by figures in parentheses after the factor as follows: (1) erosion; (2) fertility, erosion; (3) fertility; (4) salinity; (5) drainage; (6) fertility, drainage; (7) drainage, alkalinity; (8) fertility, overflow

Soil	Rating factors				Index rating	Soil grade
	A (Profile)	B (Texture)	C (Slope)	X (Other conditions)		
Antioch clay loam, 9 to 15 percent slopes, eroded	50	85	90	90(1)	34	4
Antioch loam, 0 to 2 percent slopes	60	100	100	100	60	2
Antioch loam, 2 to 5 percent slopes	60	100	100	100	60	2
Antioch loam, 5 to 9 percent slopes, eroded	55	100	95	95(1)	50	3
Arguello loam, 2 to 9 percent slopes	75	100	95	80(2)	57	3
Arguello shaly loam, 9 to 15 percent slopes	75	85	90	80(2)	46	3
Arnold loamy sand, 9 to 15 percent slopes	85	80	90	85(3)	52	3
Arnold loamy sand, 15 to 30 percent slopes, eroded	80	80	80	65(2)	33	4
Arnold loamy sand, 30 to 50 percent slopes, severely eroded	80	80	45	55(2)	16	5
Auberry fine sandy loam, 15 to 30 percent slopes	70	100	80	80(3)	45	3
Auberry fine sandy loam, 30 to 75 percent slopes, eroded	70	100	40	70(2)	20	4
Badland	----------	----------	----------	----------	[1] <5	6
Botella loam, 0 to 2 percent slopes	95	100	100	100	95	1
Botella loam, 2 to 9 percent slopes	95	100	95	100	90	1
Cibo rocky clay, shallow, 15 to 75 percent slopes, eroded	50	60	40	70(2)	9	6
Cibo stony clay, 15 to 50 percent slopes, eroded	70	60	60	70(2)	18	5
Cieneba gravelly sandy loam, 30 to 75 percent slopes, eroded	30	80	40	70(2)	7	6
Cieneba gravelly sandy loam, 15 to 75 percent slopes, severely eroded	30	80	50	50(2)	6	6
Clear Lake clay	95	60	100	100	57	3
Clear Lake clay, saline	95	60	100	75(4)	43	3
Clear Lake silty clay loam	95	85	100	70(5)	57	3
Climara clay, 9 to 15 percent slopes	70	60	90	100	38	4
Climara clay, 15 to 50 percent slopes, eroded	65	60	60	60(2)	13	5
Cometa loam, 5 to 15 percent slopes, eroded	70	100	90	70(2)	44	3
Cometa sandy loam, 5 to 15 percent slopes, eroded	70	95	90	70(2)	42	3
Conejo clay loam, 2 to 9 percent slopes	95	85	95	100	77	2
Corralitos loamy sand, 2 to 9 percent slopes	95	80	95	95(3)	69	2
Cotati loam, 2 to 9 percent slopes	60	100	95	90(3)	51	3
Cotati loam, 9 to 15 percent slopes, eroded	60	100	90	70(2)	38	4
Cotati loam, 15 to 30 percent slopes, eroded	60	100	80	60(2)	29	4
Cropley clay, 0 to 2 percent slopes	95	60	100	90(5)	51	3
Cropley clay, 2 to 9 percent slopes	95	60	95	100	54	3
Cropley silty clay loam, 2 to 9 percent slopes	95	85	95	100	77	2
Diablo clay, 9 to 15 percent slopes	80	60	90	100	43	3
Diablo clay, 15 to 30 percent slopes, eroded	80	60	80	80(1)	31	4
Diablo clay, 30 to 50 percent slopes, eroded	75	60	45	75(1)	15	5
Diablo clay, 50 to 75 percent slopes, severely eroded	60	60	30	50(2)	5	6
Diablo-Linne complex, 9 to 15 percent slopes	80	75	90	100	54	3
Diablo-Linne complex, 15 to 30 percent slopes, eroded	80	75	80	80(1)	38	4
Diablo-Linne complex, 30 to 50 percent slopes, eroded	75	75	45	80(1)	20	4
Docas clay loam, 0 to 2 percent slopes	95	85	100	100	81	1
Docas clay loam, 2 to 9 percent slopes	95	85	95	100	77	2
Docas silt loam, 0 to 2 percent slopes	95	100	100	100	95	1
Docas silt loam, 2 to 9 percent slopes	95	100	95	100	90	1
Edenvale clay, 0 to 2 percent slopes	90	60	100	100	54	3
Gaviota loam, 15 to 30 percent slopes	60	100	80	106	48	3
Gaviota loam, 15 to 30 percent slopes, eroded	45	100	80	80(1)	29	4
Gaviota loam, 30 to 50 percent slopes, eroded	40	100	45	70(1)	13	5
Gaviota rocky loam, 15 to 50 percent slopes, eroded	40	70	60	60(1)	10	5
Gazos clay loam, 15 to 30 percent slopes, eroded	60	85	80	80(1)	33	4
Gazos clay loam, 30 to 50 percent slopes, eroded	60	85	45	80(1)	18	5
Gazos clay loam, 50 to 75 percent slopes, severely eroded	50	85	30	60	8	6
Gazos silty clay loam, 9 to 15 percent slopes	70	85	90	----------	54	3
Gullied land	----------	----------	----------	----------	[1] <5	6
Hanford coarse sandy loam, 0 to 2 percent slopes	90	80	100	85(6)	61	2
Hanford coarse sandy loam, 2 to 9 percent sopes	90	80	95	85(6)	58	3
Hanford loam, 0 to 2 percent slopes	90	100	100	85(6)	77	2
Hanford loam, 2 to 9 percent slopes	90	100	95	85(6)	73	2
Henneke fine gravelly loam, 15 to 50 percent slopes, eroded	50	70	60	50(2)	11	5
Henneke soils, 15 to 75 percent slopes, severely eroded	40	60	50	40(2)	5	6
Igneous rock land	----------	----------	----------	----------	[1] <5	6
Kettleman loam, 5 to 15 percent slopes	90	100	90	100	81	1
Kettleman loam, 15 to 50 percent slopes, eroded	85	100	60	80(1)	41	3
Kettleman soils, 15 to 50 percent slopes, eroded	70	100	60	80(1)	34	4
Landslides	----------	----------	----------	----------	[1] <5	6

See footnote at end of table.

TABLE 3.—*Storie index rating for soils of San Benito County*—Continued

Soil	Rating factors				Index rating	Soil grade
	A (Profile)	B (Texture)	C (Slope)	X (Other conditions)		
Laniger gravelly sandy loam, 30 to 75 percent slopes, severely eroded	60	60	40	40(2)	6	6
Linne clay loam, 9 to 15 percent slopes	80	85	90	100	61	2
Linne clay loam, 15 to 30 percent slopes, eroded	80	85	80	80(1)	44	3
Linne clay loam, 30 to 50 percent slopes, eroded	60	85	45	70(1)	16	5
Linne clay loam, 30 to 50 percent slopes, severely eroded	50	85	45	70(1)	13	5
Linne-Shedd complex, 15 to 30 percent slopes, eroded	80	90	80	80(1)	46	3
Linne-Shedd complex, 30 to 50 percent slopes, eroded	60	90	45	70(1)	17	5
Lodo shaly loam, 50 to 75 percent slopes, eroded	50	80	40	70(1)	11	5
Los Banos clay loam, 2 to 9 percent slopes	80	85	95	85(3)	55	3
Los Banos clay loam, 9 to 15 percent slopes, eroded	80	85	90	70(2)	43	3
Los Banos clay loam, 15 to 50 percent slopes, severely eroded	80	85	60	50	20	4
Los Gatos clay loam, 15 to 30 percent slopes	80	85	80	100	55	3
Los Gatos clay loam, 30 to 50 percent slopes, eroded	65	85	45	70(1)	17	5
Los Gatos rocky clay loam, 15 to 50 percent slopes, eroded	65	70	60	70(1)	19	5
Metz gravelly sandy loam, 0 to 2 percent slopes	90	70	100	85(3)	54	3
Metz sandy loam, 0 to 2 percent slopes	95	95	100	100	90	1
Metz gravelly sandy loam, 2 to 9 percent slopes	90	70	95	85(3)	51	3
Metz sandy loam, wet variant, 0 to 2 percent slopes	90	95	100	70(7)	60	2
Mine pits and dumps	------	------	------	------	[1] <5	6
Mocho clay loam, 2 to 9 percent slopes	100	85	95	100	81	1
Mocho gravelly loam, 2 to 5 percent slopes	100	70	95	100	62	2
Mocho loam, 0 to 2 percent slopes	100	100	100	100	100	1
Mocho loam, 2 to 9 percent slopes	100	100	95	100	95	1
Mocho sandy loam, 0 to 2 percent slopes	100	95	100	100	95	1
Mocho sandy loam, 2 to 9 percent slopes	100	95	95	100	90	1
Montara rocky silty clay loam, 15 to 50 percent slopes, eroded	20	50	60	50(2)	3	6
Nacimiento clay loam, 9 to 15 percent slopes	90	85	90	100	69	2
Nacimiento clay loam, 15 to 30 percent slopes	80	85	80	90(1)	49	3
Nacimiento clay loam, 30 to 50 percent slopes, eroded	80	85	45	80(1)	25	4
Nacimiento clay loam, 50 to 75 percent slopes, eroded	65	85	30	70(1)	12	5
Nacimiento loam, 30 to 75 percent slopes, severely eroded	65	100	40	50(1)	13	5
Pacheco clay loam over clay	90	85	100	70(7)	54	3
Pacheco loam	90	100	100	70(7)	63	2
Pacheco silty clay	90	70	100	70(7)	44	3
Pacheco silt loam	90	100	100	70(7)	63	2
Panhill loam, 2 to 9 percent slopes	100	100	95	100	95	1
Panoche loam, 0 to 2 percent slopes	100	100	100	100	100	1
Panoche loam, 2 to 9 percent slopes	100	100	95	100	95	1
Panoche sandy loam, 0 to 2 percent slopes	100	95	100	100	95	1
Panoche sandy loam, 2 to 9 percent slopes	100	95	95	100	90	1
Pinnacles coarse sandy loam, 15 to 30 percent slopes, eroded	60	80	80	80(2)	31	4
Pinnacles coarse sandy loam, 30 to 75 percent slopes, severely eroded	60	80	40	40(2)	8	6
Pinto sandy loam, 15 to 30 percent slopes, eroded	70	95	80	70(2)	37	4
Pleasanton gravelly loam, 5 to 9 percent slopes, eroded	90	80	95	90(1)	62	2
Pleasanton loam, 2 to 5 percent slopes	90	100	95	100	85	1
Reiff sandy loam, 0 to 2 percent slopes	95	95	100	100	90	1
Reiff sandy loam, 2 to 9 percent slopes	95	95	95	100	85	1
Rincon loam, 0 to 2 percent slopes	85	100	100	100	85	1
Rincon loam, 2 to 9 percent slopes	85	100	95	100	81	1
Rincon loam, 9 to 15 percent slopes, eroded	85	100	90	90(1)	69	2
Rincon silty clay loam, 0 to 2 percent slopes	85	90	100	100	77	2
Rincon silty clay loam, 2 to 9 percent slopes	85	90	95	100	73	2
Rincon silty clay loam, 9 to 15 percent slopes, eroded	85	90	90	90(1)	62	2
Riverwash	------	------	------	------	[1] <5	6
Salinas clay loam, 0 to 2 percent slopes	95	85	100	100	81	1
Salinas clay loam, 2 to 9 percent slopes	95	85	95	100	77	2
San Benito clay loam, 9 to 15 percent slopes	80	85	90	100	61	2
San Benito clay loam, 15 to 30 percent slopes, eroded	75	85	80	90 (1)	46	3
San Benito clay loam, 30 to 50 percent slopes, eroded	70	85	45	85 (1)	23	4
San Benito clay loam, 30 to 50 percent slopes, severely eroded	70	85	45	80 (1)	21	4
Sandy alluvial land	90	75	100	60 (8)	41	3
Santa Lucia shaly loam, 30 to 50 percent slopes, eroded	45	80	45	70 (2)	11	5
Santa Lucia shaly loam, 30 to 75 percent slopes, severely eroded	40	80	40	50 (2)	6	6
Sedimentary rock land	------	------	------	------	[1] <5	6
Shedd loam, 9 to 15 percent slopes	65	100	90	100	58	3
Shedd loam, 15 to 30 percent slopes, eroded	60	100	80	80 (1)	38	4
Shedd loam, 30 to 50 percent slopes, eroded	45	100	45	70 (1)	14	5
Shedd loam, 30 to 50 percent slopes, severely eroded	45	100	45	50 (2)	10	5

See footnote at end of table.

TABLE 3.—*Storie index rating for soils of San Benito County*—Continued

Soil	Rating factors				Index rating	Soil grade
	A (Profile)	B (Texture)	C (Slope)	X (Other conditions)		
Sheridan coarse sandy loam, 9 to 15 percent slopes	75	90	90	90 (3)	55	3
Sheridan coarse sandy loam, 15 to 30 percent slopes	70	90	80	90 (3)	45	3
Sheridan coarse sandy loam, 15 to 30 percent slopes, eroded	65	90	80	80 (2)	37	4
Sheridan coarse sandy loam, 30 to 75 percent slopes, eroded	45	90	40	40 (2)	7	6
Sheridan coarse sandy loam, 30 to 75 percent slopes, severely eroded	35	90	40	30 (2)	4	6
Soper gravelly loam, 9 to 15 percent slopes	85	80	90	100	61	2
Soper gravelly loam, 15 to 30 percent slopes, eroded	85	80	80	80 (1)	44	3
Soper gravelly loam, 30 to 50 percent slopes, eroded	80	80	70	70 (1)	31	4
Soper sandy loam, 9 to 15 percent slopes	90	95	90	100	77	2
Soper sandy loam, 15 to 30 percent slopes, eroded	85	95	80	80 (1)	52	3
Soper sandy loam, 30 to 50 percent slopes, eroded	80	95	70	70 (1)	37	4
Sorrento gravelly loam, 0 to 5 percent slopes	85	80	95	100	65	2
Sorrento silt loam, 0 to 2 percent slopes	100	100	100	100	100	1
Sorrento silt loam, 2 to 9 percent slopes	100	100	95	100	95	1
Sorrento silty clay loam, 0 to 2 percent slopes	100	85	100	100	85	1
Sorrento silty clay loam, 2 to 9 percent slopes	100	85	95	100	81	1
Sween rocky clay loam, 15 to 30 percent slopes, eroded	65	70	80	80 (1)	29	4
Sween rocky clay loam, 30 to 50 percent slopes, eroded	65	70	45	70 (1)	14	5
Sween stony clay loam, 15 to 30 percent slopes, eroded	65	60	80	80 (2)	25	4
Sween very stony clay loam, 15 to 50 percent slopes, eroded	40	55	60	70 (2)	9	6
Terrace escarpments	-------	-------	-------	-------	[1] <5	6
Vallecitos loam, 9 to 15 percent slopes	75	100	90	100	68	2
Vallecitos loam, 15 to 30 percent slopes	70	100	80	100	56	3
Vallecitos loam, 30 to 50 percent slopes	65	100	45	80 (2)	22	4
Vallecitos loam, 30 to 50 percent slopes, eroded	60	100	45	70 (2)	19	5
Vallecitos rocky loam, 9 to 30 percent slopes, eroded	50	70	90	60 (2)	19	5
Vallecitos rocky loam, 30 to 50 percent slopes, eroded	45	70	45	50 (2)	7	6
Willows clay	80	65	100	50 (7)	26	4
Willows clay, saline-alkali	80	65	100	40 (7)	21	4
Willows sandy loam	90	95	95	80 (3)	65	2
Willows soils, eroded	80	70	100	50 (7)	28	4
Yolo gravelly loam, 0 to 5 percent slopes	90	80	95	100	69	2
Yolo loam, 0 to 2 percent slopes	95	95	100	100	90	1
Yolo loam, 2 to 9 percent slopes	95	100	95	100	69	2

[1] Index rating was estimated; rating factors were not determined.

profile justifying a rating of 100 percent for factor A, excellent texture of the surface soil justifying 100 percent for factor B, a smooth, nearly level surface justifying 100 percent for factor C, but a high accumulation of salts or alkali that would give a rating of 20 percent for factor X. Multiplying these four ratings gives an index rating of 20 for this soil. The high accumulation of salts or alkali dominates, makes the soil unproductive for crops, and justifies the low index rating of 20.

Soils are placed in grades according to their suitability for farming as shown by their Storie index ratings. The six grades and their range in index ratings are—

	Index rating
Grade 1	80 to 100
Grade 2	60 to 79
Grade 3	40 to 59
Grade 4	20 to 39
Grade 5	10 to 19
Grade 6	Less than 10

Soils of grade 1 have few or no limitations that restrict their use for crops. Soils of grade 2 are suitable for most crops, but they have minor limitations that narrow the choice of crops and have few special management needs. Grade 3 soils are suited to a few crops or to special crops and require special management. Grade 4 soils are severely limited for crops. If used for crops, they require careful management. Grade 5 soils generally are not suited to cultivated crops but can be used for pasture and range. Grade 6 consists of soils and land types that generally are not suited to farming.

Management of Pasture and Range

About 500,000 acres in San Benito County is used for grazing livestock. Cattle is the main livestock, though the number of sheep is considerable.

The forage consists of various mixtures of desirable and undesirable annual plants. The kinds of plants and the condition of the range partly depend on the kinds of soils and practices of management. Desirable plants include soft chess, ryegrass, filaree, annual clover, burclover, wild oats, and remnants of perennial grasses. Among the less desirable plants are ripgut brome, wild barley, annual fescues, red brome, wild carrot, and annual lupine. The undesirable plants include nitgrass, dogtail, tarweed, fiddleneck, popcornflower, vinegar weed, turkey mullein, thistles, and mustard.

Where an area of range is producing at or near its potential, a mixture of desirable plants makes up 70 percent or more of the vegetative cover. Less desirable plants and undesirable plants make up the remaining cover. The undesirable plants do not amount to more than 10 percent of the total cover.

The amount of forage produced, like the kinds of plants, depends on the kinds of soils and past management, and especially on the temperature and the amount and distribution of rainfall. In years when rainfall and temperature are favorable, production may be as high as 2,500 pounds per acre on a good site, but production may fall as low as 1,000 pounds on the same site when the weather is adverse. When there is enough rainfall that is well distributed through winter and spring and temperatures are moderate, the green feed period may run from December through spring and into June. The green feed period is the period when forage plants grow vigorously, are nutritious, and are at peak production. In years of low temperatures and rainfall, this period is from February into May.

In conducting a good program of management, variation of production and the length of the green feed period are considered. The program must be flexible enough to make full use of the available feed when it is most nutritious. The number of livestock on a site should be varied according to the forage available, or supplemental feed should be provided during periods when there is not enough green feed.

Pasture and range sites

The soils used for grazing in San Benito County have been grouped into pasture and range sites. Each site differs from other pasture and range sites in its ability to produce significantly different kinds and amounts of vegetation and in the management needed to keep the site in good condition. For this management it is necessary to have knowledge about the soils that make up each site and about the kinds and amounts of plants the site can produce. Then it is possible to use management, including regulation of grazing, that favors production of the most desirable forage plants.

The pasture and range sites in San Benito County are described in the following pages.

Annual air-dry production is estimated for each site. These estimates are based on a limited number of clippings, and on knowledge of the soils in sites.

SITE 1: CLAYEY

This site extends across the entire county from north to south and has an average annual rainfall of 10 to 18 inches. It consists of calcareous clays, clay loams, and silty clay loams that are more than 20 inches deep. Slopes are between 9 and 75 percent but are dominantly less than 50 percent. This site occupies about 124,000 acres.

The soils in this site have moderate to high available water holding capacity and are moderately fertile. Permeability is moderately slow to slow, and runoff is rapid.

Large acreages of these soils are arable but are used for grazing. They should be considered first if improvements are planned.

During years when moisture is favorable, the soils in this site produce heavy stands of wild oats. Stands of burclover are abundant in some years. If cows graze heavily on this burclover when it is young and lush, they may become bloated. The soils of this site are well suited to seeding of adapted annual grasses and legumes. Hardinggrass can be established in areas that receive 16 inches of rainfall. Forage plants respond well to applications of ammonium-phosphate-sulfate fertilizer.

Where the soils on this site are not fertilized and management is not improved, annual air-dry production ranges from 3,000 pounds per acre in years of favorable moisture to 1,200 pounds in years of unfavorable moisture. Except for the severely eroded soils (DaG3, LnF3, SbF3) and for an eroded soil on slopes of more than 50 percent (NaG2), total annual yields can be increased 2 to 4 times by adding fertilizer and improving management.

SITE 2: LOAMY

This site consists of strongly acid to neutral shaly loams that are 18 to 60 inches deep. The average annual precipitation on this site is 12 to 16 inches. This site occupies only about 6,000 acres. Some spots are calcareous. Slopes range from 9 to 75 percent.

The soils in this site have low to high available water holding capacity. Permeability is moderate to moderately slow, runoff is medium to rapid, and fertility is low to moderate.

Some areas of these soils are arable but are used for grazing. These soils should be considered first if improvements are planned.

Only moderately good stands of burclover grow on this site. The forage is mostly soft chess, wildoats, and filaree. The production of grasses can be improved by removing trees and brush that grow in some places. The soils of this site are well suited to seeding of adapted annual grasses and legumes. Forage plants respond well to applications of nitrogen, phosphorus, and sulfur fertilizers.

Where the soils on this site are not fertilized and management is not improved, annual air-dry production ranges from 2,400 pounds per acre in years of favorable moisture to 1,200 pounds in years of unfavorable moisture. Except for a severely eroded soil (SdG3), total annual yields can be increased 3 to 4 times by adding fertilizer and improving management.

SITE 3: GRANITIC

This site consists of soils that occur largely in the Gabilan Range in the western part of the county where average annual rainfall is 12 to 30 inches. These soils are loamy sands, gravelly loams, and fine, coarse, and gravelly sandy loams. They are more than 20 inches deep over sandstone, granite, or granitic material (fig. 15). These soils are strongly acid to slightly acid. Slopes range from 9 to 75 percent and are dominantly more than 30 percent. Some areas are severely eroded. This site occupies about 104,000 acres.

These soils have low fertility and low available water holding capacity. They are rapidly permeable and droughty. If they are not adequately protected these soils erode easily.

Small acreages of these soils are arable but are used for grazing and are included in this site.

Only a small amount of burclover grows on this site. Some open areas are covered with grass, but in most of

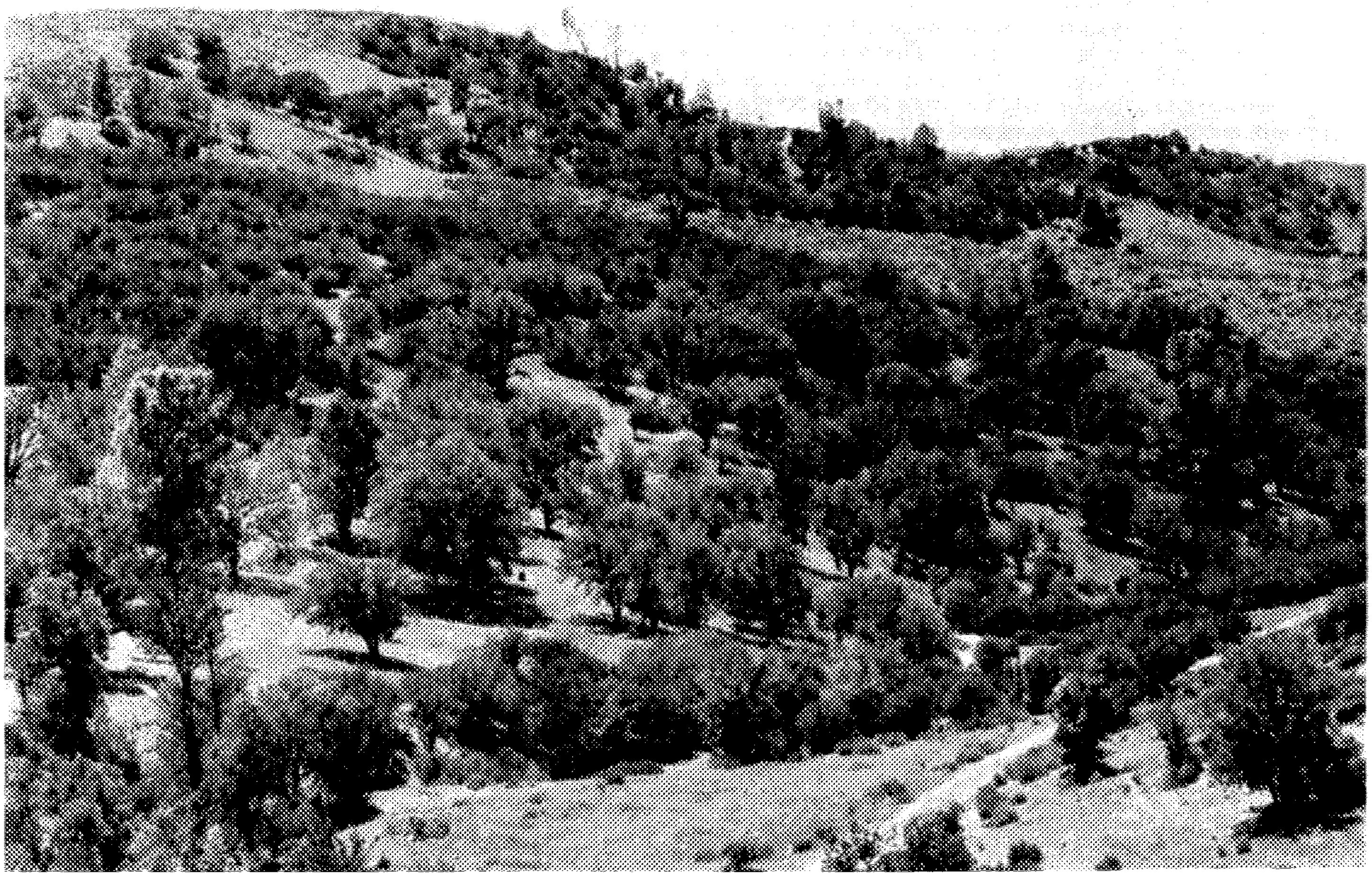

***Figure 15.*—Pinnacles coarse sandy loam, 15 to 30 percent slopes, eroded, in site 3.**

the acreage blue oak, live oak, and Digger pine are scattered or grow in heavy stands. Some areas are covered with brush. The production of forage in the areas covered by brush and trees is far below potential, but care must be used if the brush is cleared because the hazard of erosion is high.

Where the soils on this site are not fertilized and management is not improved, annual air-dry production ranges from 1,600 pounds per acre in years of favorable moisture to 800 pounds in years of unfavorable moisture. Except for the soils on slopes of more than 30 percent (AtF3, AuG2, CgG2, LaG3, PnG3, SkG2, SkG3, SlF2, SmF2,), total annual yields can be increased 3 to 4 times by adding fertilizer and improving management.

SITE 4: CLAYPAN

This site consists of soils around the edges of valleys along most of the major drainageways throughout the county where average annual rainfall is 12 to 20 inches. Exceptions are the valleys in the drier areas in the southeastern part of the county. The soils in this site are loams, gravelly loams, and sandy loams. At a depth of 12 to 20 inches, these soils have an accumulation of clay that restricts the movement of roots and water. Reaction generally ranges from strongly acid to neutral but is mildly alkaline in a few areas. Slopes range from 0 to 30 percent but are dominantly between 2 and 15 percent. This site occupies about 10,000 acres.

The soils in this site have moderate to high available water holding capacity. Permeability is moderately slow to very slow, runoff is slow to medium, and fertility is low to moderate.

Much of the acreage of these soils is arable and has been farmed to dryland grain but has been allowed to revert to range. Because they have been tilled for crops, the steeper soils are eroded, fertility is reduced, and the plant cover is poor. Little or no brush grows on this site. The soils of this site are well suited to seeding of adapted annual grasses and legumes. Forage plants respond well to applications of nitrogen, phosphorus, and sulfur fertilizers.

Where the soils on this site are not fertilized and management is not improved, annual air-dry production ranges from 2,000 pounds per acre in years of favorable moisture to 1,200 pounds in years of unfavorable moisture. Total annual yields can be increased 3 to 4 times by adding fertilizer and improving management.

SITE 5: FINE LOAMY

This site consists mainly of clayey and loamy soils, some of which are shaly, rocky, stony, or very stony. The rocky and stony clays are 20 to 60 inches deep over sandstone, shale, or basic igneous rock. The soils in this site are medium acid to slightly acid. Slopes range from 9 to 75 percent but are dominantly between 30 and 50 percent. This site occupies 62,000 acres and has an average annual rainfall of 12 to 20 inches.

These soils have low to moderate available water holding capacity and moderate fertility. Permeability is moderate to slow, and runoff is medium to very rapid.

Some areas of these soils are arable but are used for grazing. During years when moisture is favorable, the soils of this site produce thick stands of wild oats with moderate to large amounts of burclover. Moderately dense and dense stands of blue oak and live oak grow in some areas. Brush is not generally abundant.

The soils in this site are well suited to seeding of adapted annual grasses and legumes. Hardinggrass can be established in areas that receive 16 inches of rainfall. Forage plants respond well to applications of ammonium-phosphate-sulfate fertilizer.

Where the soils on this site are not fertilized and management is not improved, annual air-dry production ranges from 2,500 pounds per acre in years of favorable moisture to 1,200 pounds per acre in years of unfavorable moisture. Except for a shallow soil (CcG2), a very stony soil (SwF2), and soils on slopes of more than 50 percent (GtG3, LtG2), total annual yields can be increased 2 to 4 times by adding fertilizer and improving management.

SITE 6: SHALLOW LOAMY

This site occurs mainly in the Diablo Range along the southern and eastern boundaries of the county, where the average annual rainfall is 14 to 20 inches. It consists of gullied areas and of medium acid to neutral loams and rocky loams that are 10 to 24 inches deep over sandstone and shale. Slopes range from 9 to 50 percent but are dominantly between 30 and 50 percent. This site occupies 111,000 acres.

The soils in this site have low available water holding capacity and low to moderate fertility. Permeability is moderate, and runoff is rapid to very rapid.

Small areas of these soils are arable but are used for grazing. Only moderately good stands of burclover grow on this site. Most of the forage is soft chess, wild oats, ripgut brome, and filaree. Large acreages are covered with brush or have open to dense stands of blue oak, live oak, and some Digger pine. The production of forage on this site can be increased by removing trees and brush and seeding adapted annual grasses and legumes.

Where the soils on this site are not fertilized and management is not improved, annual air-dry production ranges from 2,000 pounds per acre in years of favorable moisture to 1,000 pounds in years of unfavorable moisture. Except for eroded soils on slopes of more than 30 percent (GaF2, VaF2), rocky eroded soils on slopes of 15 to 50 percent (GrF2, VrF2), and Gullied land (GuE), total yields can be increased 2 to 3 times by adding fertilizer and improving management.

SITE 7: DRY LOAMY

This site occurs in the southern part of the county in the drier areas west of Bitterwater Valley and on the western side of Vallecitos Valley. It has an average annual rainfall of 12 to 14 inches. It consists of calcareous loams and clay loams that are 20 to 48 inches deep over calcareous shale and sandstone. Slopes range from 9 to 50 percent. This site occupies 16,000 acres.

The soils in this site have low to moderate available water holding capacity and moderate to low fertility. Runoff is medium to rapid.

Large areas of these soils, particularly on ridgetops, have been dryfarmed to grain and are now eroded or severely eroded. Before these areas were cultivated, the native plants included wild oats, soft chess, filaree, burclover, red brome and annual fescues. The wild oats and soft chess have been replaced by red brome and annual fescues. In years of favorable moisture, stands of burclover are abundant. If cows graze heavily on this site when it is young and lush, they may become bloated. The more severely eroded areas are bare or support thin stands of California sagebrush and wild buckwheat mixed with thin stands of grasses and forbs.

The production of forage can be increased on some of the soils of this site by seeding to adapted annual grasses and legumes and by fertilizing when equipment can be operated without damage to the soils. Response to improved management is poor during years of low or poorly distributed rainfall.

The yield of forage varies greatly on this site; in years of favorable moisture grasses are abundant, but during droughty years the growth of grasses is very poor.

Where the soils on this site are not fertilized and management is not improved, annual air-dry production ranges from 2,000 pounds per acre in years of favorable moisture to 800 pounds in years of unfavorable moisture. Except for a severely eroded soil (ShF3) and an eroded soil on slopes of more than 30 percent (ShF2), total annual yields can be increased 2 to 4 times by adding fertilizer and improving management.

SITE 8: SERPENTINE LAND

The soils in this site are fine gravelly loams and rocky silty clay loams derived from serpentine. These soils are intermingled with Igneous rock land. They are 10 to 25 inches deep over bedrock. Slopes range from 15 to 50 percent. This site occupies 8,000 acres and has an average annual rainfall of 12 to 20 inches.

These soils have very low fertility. Available water holding capacity is low, and runoff is rapid.

Most of this site is covered with brush, but there are small open areas of grasses. Less desirable annual fescues are dominant in most areas. Burclover generally does not grow on this site. Much of this site is inaccessible, because it is intermingled with Igneous rock land and watershed areas. Generally it is not feasible to reseed or fertilize the soil of this site.

On this site total annual air-dry production is 1,200 pounds per acre in years of favorable moisture and 500 pounds in years of unfavorable moisture.

SITE 9: ARID LOAMY HILLS

This site consists of soils in the southeastern corner of the county along the Fresno County line where the average annual rainfall is 6 to 12 inches. These soils are calcareous loams, rocky loams, and clay loams that are 18 to 40 inches deep over soft calcareous sandstone and shale. Slopes range from 5 to 50 percent. Many areas have been overgrazed in the past and are severely eroded, especially on south-facing slopes. This site occupies 47,000 acres.

These soils have low to moderate available water holding capacity. Permeability is moderate to moderately rapid, and runoff is medium to rapid.

Red brome and filaree are the dominant vegetation on this site. Only in years of above average rainfall does burclover grow well on this site. Because rainfall is low, the production of forage varies. Grazing should be permitted only during years of adequate production. The site is more suitable for grazing by sheep than cattle; it is easier to herd the sheep and keep them off the bare south-facing slopes. It is not feasible to reseed or fertilize the site.

On this site total annual air-dry production ranges from 1,500 pounds per acre in years of favorable moisture to 500 pounds per acre in years of unfavorable moisture.

SITE 10: ARID FANS

This site consists of soils on fans, terraces, and flood plains in Panoche and Vallecitos Valleys (fig. 16) where the average annual rainfall is 6 to 12 inches. These soils are calcareous loams, sandy loams, and clay loams that are more than 20 inches deep over stratified calcareous gravel, sand, and clay. Slopes range from 0 to 15 percent. The site occupies about 12,000 acres.

The soils in this site have moderate to high available water holding capacity and moderate to slow permeability. Runoff is very slow to medium. The hazard of erosion is slight to moderate and has been increased by overgrazing and compaction of the soils.

This site is easily accessible and has been so heavily grazed that vinegar weed, turkey mullein, and tarweed have invaded and are the dominant plants. Red brome and filaree provide most of the forage in spring. Burclover grows well only in years when rainfall is above average. It is not feasible to reseed or fertilize these soils.

On this site total annual air-dry production ranges from 1,800 pounds per acre in years of favorable moisture to 600 pounds per acre in years of unfavorable moisture.

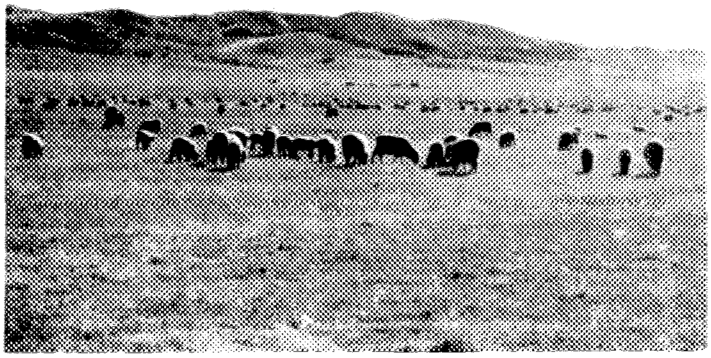

Figure 16.—**Sheep grazing on Panoche loam, 2 to 9 percent slopes, in site 10. This long gently sloping fan in the Panoche Valley is used extensively for grazing in winter and spring. The hills in the background are Los Banos clay loam, 15 to 50 percent slopes, severely eroded, in site 9.**

SITE 11: POORLY DRAINED BOTTOMS

This site consists of soils in low lying valley bottoms in the northern portion of the county. These soils are deep, somewhat poorly drained and poorly drained loams and clays that are moderately to severely affected by salts and alkali. Slopes are less than 2 percent.

The soils in this site have moderately slow to very slow permeability. This site occupies about 7,200 acres. Available water holding capacity is high, and there is no runoff. These soils remain moist late in the year.

The forage of this site is mostly soft chess, wild oats, and ryegrass. Production is better in years of lower rainfall because excess moisture does not collect and retard growth of the higher producing plants. The forage on this site remains green and palatable somewhat longer than that on other sites because of the extra moisture. The growth of grasses is reduced in areas severely affected by salts and alkali. Hardinggrass is adapted and can be established on this site in years when the proper seedbed can be prepared. Forage plants respond well to applications of nitrogen, phosphorus, and sulfur.

Where the soils on this site are not fertilized and managed, annual air-dry production ranges from 3,500 pounds per acre in years of favorable moisture to 2,000 pounds per acre in years of unfavorable moisture. Total annual yields can be increased 2 to 3 times by adding fertilizer and improving management.

Engineering Uses of the Soils

The properties of soils are important to engineers because soils support dams, highways, reservoirs, buildings, and other structures and are used as materials for constructing roads, dams, foundations for houses, and other uses. These properties include strength, permeability, compaction, shrink-swell potential, water-holding capacity, grain size, and plasticity.

With the use of the soil map for identification, the engineering interpretations in this section can be useful for many purposes. It should be emphasized that they may not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and where the excavations are deeper than the depths of layers here reported. Even in these situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

The information in this survey can be used to—

1. Make soil and land use studies that will aid in selecting and developing sites for industries, businesses, residences, and recreational areas.

2. Make preliminary estimates of the engineering properties of soils in the planning of agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines, and cables and in planning detailed investigations at the selected locations.
4. Locate probable sources of gravel and other materials suitable for construction.
5. Correlate performance of engineering structures with soil mapping units to develop information for overall planning that will be useful in designing and maintaining certain engineering practices and structures.
6. Determine the suitability of soil mapping units for cross-country movement of vehicles and construction equipment.
7. Supplement the information obtained from other published maps and reports and aerial photo-

TABLE 4.—*Estimated engineering*

[Absence of data indicates

Soil series and map symbols [1]	Hydraulic soil group	Depth to bedrock or hardpan	Depth from surface in typical profile	Classification		
				Dominant USDA texture	Unified	AASHO
		Feet	*Inches*			
Antioch: AnA, AnB, AnC2, AoD2	D	5+	0 to 13	Loam or clay loam	CL	A-4, A-6
			13 to 37	Clay	CH	A-7
			37 to 76	Loam to silty clay loam	CL	A-6
Arguello: ArC, AsD	C	5+	0 to 21	Loam or shaly loam	CL	A-4
			21 to 50	Clay loam or shaly clay loam.	CL	A-6
			50 to 60	Very shaly clay loam	GP or GC	A-2
Arnold: AtD, AtE2, AtF3	B	2 to 5	0 to 46	Loamy sand	SM	A-2
			46 to 90	Soft sandstone.		
Auberry: AuE, AuG2	C	2 to 5	0 to 37	Fine sandy loam to coarse sandy clay loam.	SC	A-4
			37 to 64	Coarse sandy loam	SM	A-2
			64 to 100	Weathered granite.		
Botella: BoA, BoC	C	5+	0 to 16	Loam	ML	A-4
			16 to 72	Clay loam	CL	A-6
Cibo: CbF2, CcG2	D	1½ to 3½	0 to 37	Stony clay	CH	A-7
			37	Fractured, weathered basic igneous rock.		
Cieneba: CgG2, CgG3	B	½ to 1½	0 to 10	Gravelly sandy loam	SM	A-2
			10	Weathered granite.		
Clear Lake: Ch, Ck, Cl	D	5+	0 to 70	Clay	CH	A-7
Climara: CmD, CmF2	D	2 to 5	0 to 36	Clay	CH	A-7
			36	Serpentine.		
Cometa: CoD2, CnD2	C	5+	0 to 18	Sandy loam to loam	SM	A-2 or A-4
			18 to 38	Clay	CH	A-7
			38 to 50	Coarse sandy clay loam.	SC	A-4
Conejo: CpC	C	5+	0 to 55	Clay loam	CL	A-6
Corralitos: CuC	A	5+	0 to 42	Loamy sand	SM	A-2
			42 to 84	Stratified sands	SP	A-1
Cotati: CvC, CvD2, CvE2	D	5+	0 to 17	Loam	ML	A-4
			17 to 35	Sandy clay	CH	A-7
			34 to 50	Gravelly sandy loam	SM	A-2

See footnote at end of table.

graphs to make maps and reports that can be used readily by engineers.

8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

Much of the information in this section is given in tables 4, 5, and 6. In table 4 properties of the soils that are important to engineering are estimated. Table 5 indicates the suitability of the soils for various engineering uses. Table 6 contains test data for series in the county.

Additional information useful for engineering can be obtained from the soil map and from other parts of the survey, particularly the section "Descriptions of the Soils" and "Formation and Classification of Soils." By using the information in this soil survey, the engineer can concentrate on the most suitable soils for engineering purposes. Then a minimum number of soil samples will be needed for laboratory testing and an adequate investigation can be made at minimum cost.

Some of the terms used by the soil scientist may be unfamiliar to the engineer, and some words may have a special meaning in soil science. These and other special terms used in this survey are defined in the Glossary.

properties of soils

estimate was not made]

Percentage passing sieve—					Permeability	Available water capacity	Reaction	Shrink-swell potential	Potential corrosion of uncoated steel
3 inches	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)					
					Inches per hour	*Inches per inch of soil*	*pH value*		
100	100	95–100	85–95	60–80	0.2 to 2.5	0.14 to 0.18	5.6 to 6.5	Moderate	Moderate.
100	100	100	90–100	75–85	Less than 0.05	0.14 to 0.16	5.6 to 8.4	High	High.
100	100	100	85–95	70–80	0.8 to 2.5	0.14 to 0.18	7.4 to 8.4	Moderate	Moderate.
95–100	90–100	70–100	65–90	50–70	0.8 to 2.5	0.10 to 0.14	5.6 to 6.5	Low to moderate	Low to moderate
95–100	90–100	70–100	65–90	55–75	0.2 to 0.8	0.14 to 0.18	5.1 to 6.0	Moderate	Low to moderate
50–75	40–55	25–40	20–35	15–30	0.8 to 2.5	0.06 to 0.08	5.1 to 6.0	Low	Low.
100	100	95–100	70–85	25–35	5.0 to 10.0	0.06 to 0.08	5.1 to 6.0	Low	Low.
100	100	100	80–90	35–50	0.8 to 2.5	0.14 to 0.16	5.6 to 6.0	Moderate	Moderate.
100	100	100	60–70	25–35	5.0 to 10.0	0.10 to 0.12	5.6 to 6.0	Low	Low.
100	100	100	85–95	65–75	0.8 to 2.5	0.14 to 0.16	5.6 to 6.5	Moderate	Low.
100	100	100	90–100	70–80	0.2 to 0.8	0.18 to 0.20	6.1 to 7.3	Moderate	Moderate.
70–90	65–90	60–90	50–80	40–60	0.05 to 0.2	0.10 to 0.12	6.1 to 9.3	High	High.
95–100	70–85	70–85	45–55	15–25	5.0 to 10.0	0.08 to 0.10	5.6 to 6.0	Low	Low.
100	100	100	90–100	90–100	0.05 to 0.2	0.14 to 0.16	7.4 to 8.4	High	High.
100	90–100	90–100	80–90	75–85	0.05 to 0.2	0.14 to 0.16	6.6 to 8.4	High	High.
100	100	100	60–70	30–50	2.5 to 5.0	0.10 to 0.14	5.6 to 6.0	Low	Low.
100	100	100	90–100	70–80	<0.05	0.14 to 0.16	6.1 to 6.5	High	High.
100	100	100	80–90	35–45	0.8 to 2.5	0.10 to 0.12	6.6 to 7.8	Low	Low.
100	100	100	90–100	70–80	0.2 to 0.8	0.18 to 0.20	6.6 to 7.8	Moderate	Moderate.
100	100	90–100	50–75	15–25	5.0 to 10.0	0.07 to 0.09	5.1 to 6.0	Low	Low.
100	100	90–100	50–70	5–15	More than 10.0	0.04 to 0.06	5.1 to 6.0	Low	Low.
100	100	100	90–100	60–70	0.8 to 2.5	0.14 to 0.16	5.1 to 6.0	Moderate	Moderate.
100	100	100	90–100	75–85	Less than 0.05	0.14 to 0.16	5.1 to 6.0	High	High.
95–100	70–85	50–80	45–55	25–35	2.5 to 5.0	0.09 to 0.11	5.1 to 6.5	Low	Low.

TABLE 4.—*Estimated engineering*

Soil series and map symbols [1]	Hydraulic soil group	Depth to bedrock or hardpan	Depth from surface in typical profile	Classification		
				Dominant USDA texture	Unified	AASHO
		Feet	*Inches*			
Cropley: CwA, CwC, CyC	D	5+	0 to 42	Clay	CH	A-7
			42 to 65	Sandy clay loam	SC	A-4
Diablo: DaD, DaE2, DaF2, DaG3, DlD, DlE2, DlF2. (For properties of the Linne soils in mapping units DlD, DlE2, and DlF2, refer to the Linne series.)	D	2½ to 6	0 to 68	Clay	CH	A-7
			68 to 90	Calcareous shale.		
Docas: DoA, DoC, DsA, DsC	B	5+	0 to 88	Silt loam or clay loam	ML or CL	A-4
Edenvale: EcA	D	5+	0 to 60	Clay	CH	A-7
Gaviota: GaE, GaE2, GaF2, GrE2	C	½ to 2	0 to 19	Loam over gravelly loam.	SM-SC	A-4
			19	Sandstone.		
Gazos: GtE2, GtF2, GtG3, GsD	C	2 to 5	0 to 46	Clay loam	CL	A-6
			46	Shale.		
Hanford: HaA, HaC, HfA, HfC	B	5+	0 to 26	Coarse sandy loam to loam.	SM	A-2
			26 to 70	Stratified loamy coarse sand and coarse sandy loam.	SM	A-2
Henneke: HnF2, HsG3	D	1½ to 2	0 to 25	Very gravelly clay loam	GC or GM	A-2
			25	Serpentine.		
Kettleman: KeD, KeF2, KmF2	C	2 to 5	0 to 51	Loam	ML	A-4
			51	Calcareous sandstone.		
Laniger: LaG3	B	1½ to 4	0 to 29	Gravelly sandy loam	SM	A-2
			29	Conglomerate.		
Linne: LnD, LnE2, LnF2, LnF3, LsE2, LsF2. (For properties of Shedd soils in mapping units LsE2, and LsF2, refer to the Shedd series.)	C	2 to 4	0 to 38	Clay loam	CL	A-6
			38	Calcareous shale.		
Lodo: LtG2	C	1 to 1½	0 to 14	Shaly loam	SM-SC	A-4
			14	Shale.		
Los Banos: LuC, LuD2, LuF3	C	5+	0 to 13	Clay loam	CL	A-6
			13 to 23	Clay	CH	A-7
			23	Semiconsolidated sand, gravel, and clay.		
Los Gatos: LvE, LvF2, LwF2	C	1½ to 5	0 to 42	Clay loam	CL	A-6
			42	Hard sandstone.		
Metz:						
MeA	A	5+	0 to 14	Sandy loam	SM	A-2 or A-4
			14 to 43	Sand	SP	A-3
			43 to 60	Sand and gravel	SP and GP	A-1
MgA, MgC	A	5+	0 to 14	Gravelly sandy loam	SM	A-2
			14 to 60	Gravelly sand	SP and GP	A-1
MhA	A	5+	0 to 18	Sandy loam	SM	A-2 or A-4
			18 to 50	Loamy fine sand	SM	A-2
			50 to 60	Loam	ML	A-4

See footnote at end of table.

properties of soils—Continued

Percentage passing sieve—					Permeability	Available water capacity	Reaction	Shrink-swell potential	Potential corrosion of uncoated steel
3 inches	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)					
					Inches per hour	*Inches per inch of soil*	*pH value*		
100	100	100	90–100	75–85	0. 05 to 0. 2	0. 14 to 0. 16	6. 6 to 8. 4	High	High.
100	100	100	80–90	40–50	0. 2 to 0. 8	0. 14 to 0. 16	7. 9 to 8. 4	Moderate	Moderate.
100	100	100	90–100	85–95	0. 05 to 0. 2	0. 14 to 0. 16	7. 4 to 8. 4	High	High.
100	100	100	90–100	80–90	0. 8 to 2. 5	0. 18 to 0. 20	7. 4 to 8. 4	Moderate	Low to moderate.
100	100	100	90–100	85–95	0. 05 to 0. 2	0. 14 to 0. 16	6. 6 to 8. 4	High	High.
100	60–90	50–80	45–75	35–50	0. 8 to 2. 5	0. 10 to 0. 12	5. 6 to 6. 5	Low	Low.
100	100	100	90–100	70–80	0. 2 to 0. 8	0. 16 to 0. 17	5. 6 to 6. 5	Moderate	Moderate.
100	100	100	60–70	25–35	5. 0 to 10. 0	0. 12 to 0. 14	6. 1 to 6. 5	Low	Low.
100	100	100	60–70	10–20	5. 0 to 10. 0	0. 09 to 0. 11	6. 1 to 6. 5	Low	Low.
95–100	30–60	20–50	15–40	10–25	0. 2 to 0. 8	0. 06 to 0. 08	6. 1 to 7. 3	Low	Low.
100	100	95–100	85–95	55–65	0. 8 to 2. 5	0. 14 to 0. 16	7. 4 to 8. 4	Low	Low.
95–100	70–85	50–80	45–55	15–25	5. 0 to 10. 1	0. 07 to 0. 09	5. 6 to 7. 3	Low	Low.
100	100	100	95–100	85–95	0. 2 to 0. 8	0. 18 to 0. 20	7. 9 to 8. 4	Moderate	Moderate.
100	80–90	60–80	55–75	35–50	2. 5 to 5. 0	0. 10 to 0. 12	6. 1 to 6. 5	Low	Low.
100	100	100	90–100	70–80	0. 2 to 0. 8	0. 18 to 0. 20	7. 4 to 7. 8	Moderate	Moderate.
100	100	100	90–100	85–95	0. 05 to 0. 2	0. 14 to 0. 16	7. 9 to 8. 4	High	High.
100	95–100	90–100	90–100	70–80	0. 2 to 0. 8	0. 18 to 0. 20	5. 6 to 6. 5	Moderate	Moderate.
100	95–100	95–100	60–70	30–40	2. 5 to 5. 0	0. 12 to 0. 14	7. 4 to 8. 4	Low	Low.
100	90–100	90–100	45–60	5–10	5. 0 to 10. 0	0. 05 to 0. 07	7. 4 to 8. 4	Low	Low.
100	50–80	40–70	30–60	0–5	More than 10. 0	0. 04 to 0. 05	7. 4 to 8. 4	Low	Low.
100	65–85	60–75	50–65	15–25	2. 5 to 5. 0	0. 07 to 0. 09	7. 4 to 8. 4	Low	Low.
100	50–80	40–70	30–60	0–5	More than 10. 0	0. 04 to 0. 05	7. 4 to 8. 4	Low	Low.
100	95–100	95–100	60–70	30–40	2. 5 to 5. 0	0. 12 to 0. 14	7. 4 to 8. 4	Low	Moderate.
100	95–100	95–100	50–60	15–25	5. 0 to 10. 0	0. 08 to 0. 10	7. 9 to 8. 4	Low	Moderate.
100	100	100	85–95	60–70	0. 8 to 2. 5	0. 14 to 0. 16	7. 9 to 8. 4	Moderate	Moderate.

TABLE 4.—*Estimated engineering*

Soil series and map symbols[1]	Hydraulic soil group	Depth to bedrock or hardpan	Depth from surface in typical profile	Classification		
				Dominant USDA texture	Unified	AASHO
		Feet	*Inches*			
Mocho:						
MoA, MoC	B	5+	0 to 60	Sandy loam	SM	A–2 or A–4
MpA, MpC	B	5+	0 to 60	Loam and fine sandy loam.	ML	A–4
MrB	B	5+	0 to 60	Gravelly loam	SM or SC	A–4
MsC	C	5+	0 to 60	Clay loam to silty clay loam.	CL	A–6
Montara: MtF2	D	½ to 1½	0 to 12	Silty clay loam	CL	A–6
			12	Serpentine.		
Nacimiento: NaD, NaE, NaF2, NaG2, NcG3.	C	2 to 5	0 to 40	Clay loam	CL	A–6
			40	Weathered clacareous shale and sandstone.		
Pacheco:						
Pa, Pc	D	5+	0 to 20	Silt loam and loam	ML	A–4
			20 to 105	Clay loam	ML or CL	A–6
Pd	D	5+	0 to 30	Clay loam	CL	A–6
			30 to 60	Clay	CH	A–7
Pe	D	5+	0 to 15	Silty clay	CH	A–7
			15 to 60	Clay loam	CL	A–6
Panhill: PhC	B	5+	0 to 60	Loam	ML	A–4
Panoche: PlA, PlC, PkA, PkC	B	5+	0 to 76	Loam[2]	ML or CL	A–4 or A–6
Pinnacles: PnE2, PnG3	C	2 to 4	0 to 12	Coarse sandy loam	SM	A–2
			12 to 25	Coarse sandy clay	CH	A–7
			25	Semiconsolidated arkosic sandstone.		
Pinto: PsE2	B	2 to 3	0 to 29	Heavy sandy loam	SM or SC	A–2 or A–4
			29 to 63	Weakly cemented hardpan.		
Pleasanton:						
PtB	C	5+	0 to 21	Loam	ML	A–4
			21 to 55	Clay loam	CL	A–6
			55 to 90	Stratified sand, gravel, and clay.	GC or GM	A–2
PvC2	C	5+	0 to 20	Gravelly loam	SM–SC	A–4
			20 to 36	Gravelly clay loam	CL	A–4
			36 to 60	Stratified sand, gravel, and clay loam.	GC or GM	A–2
Reiff: ReA, ReC	B	5+	0 to 42	Sandy loam	SM	A–2 or A–4
			42 to 60	Loam	ML	A–4
Rincon: RnA, RnC, RnD2, RsA, RsC, RsD2.	C	5+	0 to 23	Silty clay loam[3]	CL	A–7
			23 to 45	Clay	CH	A–7
			45 to 80	Clay loam	ML	A–4
Salinas: SaA, SaC	C	5+	0 to 66	Clay loam	CL	A–6

See footnotes at end of table.

properties of soils—Continued

Percentage passing sieve—					Permeability	Available water capacity	Reaction	Shrink-swell potential	Potential corrosion of uncoated steel
3 inches	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)					
					Inches per hour	*Inches per inch of soil*	*pH value*		
100	95–100	95–100	60–70	30–40	2. 5 to 5. 0	0. 11 to 0. 13	7. 9 to 8. 4	Low	Low.
100	95–100	95–100	85–95	60–70	0. 8 to 2. 5	0. 14 to 0. 16	7. 9 to 8. 4	Moderate	Low.
95–100	75–90	70–85	60–70	35–45	2. 5 to 5. 0	0. 10 to 0. 12	7. 9 to 8. 4	Low	Low.
100	100	100	90–100	70–80	0. 2 to 0. 8	0. 18 to 0. 20	7. 9 to 8. 4	Moderate	Moderate.
100	100	100	95–100	85–95	0. 2 to 0. 8	0. 18 to 0. 20	6. 6 to 7. 8	Moderate	Moderate.
100	100	95–100	90–95	70–80	0. 2 to 0. 8	0. 18 to 0. 20	7. 9 to 8. 4	Moderate	Moderate.
100	100	95–100	90–100	85–95	0. 8 to 2. 5	0. 18 to 0. 20	7. 9 to 8. 4	Moderate	High.
100	100	95–100	90–100	85–95	0. 2 to 0. 8	0. 18 to 0. 20	7. 9 to 8. 4	Moderate	High.
100	100	95–100	90–100	85–95	0. 2 to 0. 8	0. 18 to 0. 20	7. 9 to 8. 4	Moderate	High.
100	100	95–100	90–100	75–95	0. 05 to 0. 2	0. 14 to 0. 16	7. 9 to 8. 4	High	High.
100	100	95–100	90–100	75–95	0. 05 to 0. 2	0. 14 to 0. 16	7. 9 to 8. 4	High	High.
100	100	100	90–100	85–95	0. 2 to 0. 8	0. 18 to 0. 20	7. 9 to 8. 4	Moderate	High.
100	100	95–100	75–95	50–70	0. 8 to 2. 5	0. 14 to 0. 16	6. 6 to 8. 4	Moderate	Low.
100	100	100	90–100	75–85	0. 8 to 2. 5	0. 14 to 0. 16	7. 4 to 8. 4	Moderate	Low.
100	90–100	85–95	50–60	25–35	2. 5 to 5. 0	0. 12 to 0. 14	5. 6 to 6. 0	Low	Low.
100	90–100	90–100	70–80	50–60	0. 05 to 0. 2	0. 14 to 0. 16	5. 1 to 5. 5	High	High.
100	100	100	60–70	30–40	0. 8 to 2. 5 0. 05 to 0. 20	0. 12 to 0. 14	5. 1 to 5. 5	Low	Low.
100	100	100	85–95	60–70	0. 8 to 2. 5	0. 14 to 0. 16	6. 1 to 7. 3	Moderate	Low.
100	100	100	95–100	70–80	0. 2 to 0. 8	0. 16 to 0. 18	6. 6 to 7. 3	Moderate	Moderate.
100	60–90	50–80	30–40	10–20	0. 08 to 2. 5	0. 08 to 0. 10	7. 4 to 7. 8	Low	Low.
100	75–95	70–90	55–70	35–50	0. 5 to 2. 5	0. 10 to 0. 12	6. 1 to 7. 3	Low	Low.
100	75–95	70–90	70–85	50–60	0. 2 to 0. 8	0. 12 to 0. 14	6. 6 to 7. 3	Moderate	Moderate.
100	60–90	30–50	20–35	5–15	0. 08 to 2. 5	0. 08 to 0. 10	7. 4 to 7. 8	Low	Low.
		50–80	30–40	10–20					
100	95–100	90–100	60–70	30–40	2. 5 to 5. 0	0. 12 to 0. 14	6. 6 to 7. 8	Low	Low.
100	95–100	90–100	85–95	60–70	0. 8 to 2. 5	0. 14 to 0. 16	7. 9 to 8. 4	Moderate	Low.
100	100	100	95–100	85–95	0. 2 to 0. 8	0. 18 to 0. 20	7. 4 to 7. 8	Moderate to high	Moderate.
100	100	100	95–100	85–95	0. 05 to 0. 2	0. 14 to 0. 16	7. 4 to 8. 4	High	High.
100	100	95–100	90–100	70–80	0. 2 to 0. 8	0. 18 to 0. 20	7. 9 to 8. 4	Moderate	Moderate.
100	100	95–100	90–100	70–80	0. 2 to 0. 8	0. 18 to 0. 20	6. 6 to 8. 4	Moderate	Moderate.

TABLE 4.—*Estimated engineering*

Soil series and map symbols [1]	Hydraulic soil group	Depth to bedrock or hardpan	Depth from surface in typical profile	Classification		
				Dominant USDA texture	Unified	AASHO
		Feet	*Inches*			
San Benito: SbD, SbE2, SbF2, SbF3	C	2 to 4	0 to 42	Clay loam	CL	A-6
			42	Shale.		
Santa Lucia: SdF2, SdG3	B	1½ to 3½	0 to 22	Very shaly loam	GM	A-1
			22	Shale.		
Shedd: ShD, ShE2, ShF2, ShF3	C	1½ to 3½	0 to 20	Loam	ML	A-4
			20 to 32	Stony loam	SM	A-4
			32 to 60	Soft calcareous sandstone.		
Sheridan: SkD, SkE, SkE2, SkG2, SkG3	B	1½ to 5	0 to 52	Coarse sandy loam	SM	A-2
			52	Granite.		
Soper: SID, SIE2, SIF2, SmD, SmE2, SmF2.	C	2½ to 4	0 to 16	Fine sandy loam and gravelly loam.	SM	A-2, A-4
			16 to 30	Sandy clay loam	SC	A-4
			30 to 42	Loamy sand	SM	A-2
			42	Conglomerate.		
Sorrento:						
SnA, SnC	B	5+	0 to 78	Silt loam	ML	A-4
SoB	B	5+	0 to 60	Gravelly loam	SM	A-4
SrA, SrC	C	5+	0 to 60	Silty clay loam	CL	A-6 or A-7
Sween:						
SsE2, SsF2	D	1½ to 4½	0 to 13	Rocky clay loam	CL	A-6
			13 to 27	Clay	CH	A-7
			27 to 32	Coarse sandy loam	SM	A-2
			32	Basic igneous rock.		
StE2, SwF2	D	1½ to 2½	0 to 12	Stony and very stony clay loam.	CL	A-6
			12 to 24	Stony and very stony clay.	CH	A-7
			24	Basic igneous rock.		
Vallecitos: VaD, VaE, VaF, VaF2, VrE2, VrF2.	C	1 to 3	0 to 8	Loam	SM or SC	A-4
			8 to 18	Gravelly clay	CL	A-4
			18	Sandstone.		
Willows: Wc, Wk, Ws, Ww2	D	5+	0 to 84	Clay [4]	CH	A-7
Yolo:						
YoA, YoC	B	5+	0 to 48	Loam	ML	A-4
			48 to 60	Gravelly loam	SM to ML	A-4
YvB	B	5+	0 to 60	Gravelly loam	SM	A-4

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[1] Because they vary, properties were not estimated for Badland (BaG), Gullied land (GuE), Igneous rock land (IgG), Landslides (LdF) Mine pits and dumps (MnG), Riverwash (Rw), Sandy alluvial land (Sc), Sedimentary rock land (SeG), and Terrace escarpments (TeF)

properties of soils—Continued

Percentage passing sieve—					Permeability	Available water capacity	Reaction	Shrink-swell potential	Potential corrosion of uncoated steel
3 inches	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)					
					Inches per hour	*Inches per inch of soil*	*pH value*		
100	100	95–100	90–100	70–80	0. 2 to 0. 8	0. 18 to 0. 20	6. 6 to 8. 4	Moderate	Moderate.
80–100	60–70	30–50	20–40	10–20	2. 5 to 5. 0	0. 06 to 0. 08	5. 6 to 6. 5	Low	Low.
100	100	95–100	85–95	50–65	0. 8 to 2. 5	0. 16 to 0. 18	7. 9 to 8. 4	Moderate	Low.
70–90	65–85	60–80	50–70	40–50	0. 8 to 2. 5	0. 10 to 0. 12	7. 9 to 8. 4	Low	Low.
100	95–100	90–100	50–60	25–35	2. 5 to 5. 0	0. 10 to 0. 12	5. 6 to 6. 5	Low	Low.
100	75–100	70–100	65–75	30–50	0. 8 to 5. 0	0. 14 to 0. 16	5. 6 to 6. 0	Low	Moderate.
100	100	100	80–90	35–45	0. 2 to 0. 8	0. 14 to 0. 16	6. 1 to 6. 5	Moderate	Moderate.
100	100	100	50–75	15–30	5. 0 to 10. 0	0. 06 to 0. 08	6. 1 to 6. 5	Low	Low.
100	100	95–100	90–100	70–90	0. 8 to 2. 5	0. 18 to 0. 20	7. 4 to 8. 4	Moderate	Low.
100	75–90	70–85	60–70	40–50	0. 8 to 2. 5	0. 10 to 0. 12	7. 4 to 8. 4	Low	Low.
100	95–100	90–100	95–100	85–95	0. 2 to 0. 8	0. 18 to 0. 20	7. 4 to 8. 4	Moderate	Moderate.
100	100	100	90–100	70–80	0. 2 to 0. 8	0. 18 to 0. 20	5. 6 to 6. 5	Moderate	Moderate.
100	100	100	90–100	75–95	0. 05 to 0. 2	0. 14 to 0. 16	6. 6 to 7. 3	High	High.
100	100	100	60–70	25–35	5. 0 to 10. 1	0. 10 to 0. 12	7. 4 to 7. 8	Low	Low.
45–70	30–60	30–60	20–45	15–35	0. 8 to 2. 5	0. 06 to 0. 10	5. 6 to 6. 5	Low	Low.
90–100	90–100	90–100	85–95	70–90	0. 05 to 0. 2	0. 06 to 0. 08	6. 6 to 7. 3	Low to moderate	High.
95–100	90–100	80–90	60–70	40–50	0. 8 to 2. 5	0. 14 to 0. 16	6. 1 to 6. 5	Moderate	Moderate.
100	80–95	75–85	65–75	50–60	0. 05 to 0. 2	0. 12 to 0. 14	6. 1 to 6. 5	Moderate	High.
100	100	100	90–100	90–100	Less than 0. 05	0. 14 to 0. 16	7. 4 to 8. 4	High	High.
100	100	100	90–100	70–90	0. 8 to 2. 5	0. 14 to 0. 16	5. 6 to 7. 3	Moderate	Low.
95–100	70–85	70–85	55–70	45–65	0. 8 to 2. 5	0. 14 to 0. 16	7. 4 to 7. 8	Moderate	Low.
100	75–90	70–85	55–70	40–50	0. 8 to 2. 5	0. 10 to 0. 12	5. 6 to 7. 8	Low	Low.

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[2] Sandy loam surface layer in places.
[3] Loam surface layer in places.
[4] Sandy loam overwash in places.

TABLE 5.—*Engineering*

Soil series and map symbols[1]	Suitability as source of—		
	Topsoil	Sand and gravel	Road fill
Antioch: AnA, AnB, AnC2, AoD2	Fair in surface layer; poor in subsoil and substratum.	Unsuitable	Fair in surface layer; poor in subsoil; fair in substratum.
Arguello: ArC, AsD	Fair in surface layer and subsoil; poor in substratum.	Unsuitable in surface layer and subsoil; fair in substratum.	Fair in surface layer and subsoil; good in substratum.
Arnold: AtD, AtE2, AtF3	Poor	Fair	Good
Auberry: AuE, AuG2	Fair	Unsuitable	Good in surface layer and subsoil.
Botella: BoA, BoC	Fair in surface layer and subsoil.	Unsuitable	Fair in surface layer and subsoil.
Cibo: CbF2, CcG2	Poor	Unsuitable	Poor
Cieneba: CgG2, CgG3	Poor	Poor	Good
Clear Lake: Ch, Ck, Cl	Poor	Unsuitable	Poor
Climara: CmD, CmF2	Poor	Unsuitable	Poor
Cometa: CoD2, CnD2	Poor	Unsuitable	Good in surface layer; poor in subsoil; fair in substratum.
Conejo: CpC	Fair	Unsuitable	Fair
Corralitos: CuC	Poor	Fair in surface layer; good in substratum.	Good
Cotati: CvC, CvD2, CvE2	Poor	Unsuitable in surface layer and subsoil; poor in substratum.	Poor in surface layer and subsoil; good in substratum.
Cropley: CwA, CwC, CyC	Poor	Unsuitable	Poor

See footnote at end of table.

interpretations of soils

Soil features affecting—				Soil limitations for use as septic tank filter field
Road location	Water-retention structures		Irrigation	
	Embankments	Reservoir area		
Very slow permeability in clay subsoil; moderate to high shrink-swell potential.	Low strength; cracks when dry; moderate to high shrink-swell potential.	Very slow permeability.	Shallow over claypan; low water-holding capacity; moderate intake rate.	Severe: Very slow permeability in subsoil; slopes of as much as 9 percent.
Clay loam subsoil; low to moderate shrink-swell potential.	Moderate strength; subject to piping and cracking; low to moderate shrink-swell potential.	Moderately slow permeability.	Most features favorable.	Severe: Moderately slow permeability in subsoil; slopes of as much as 9 percent.
Slopes of more than 15 percent; bedrock at depth of 2 to 5 feet.	Moderate strength; subject to piping; bedrock at a depth of 3 to 5 feet.	Rapid permeability; steep slopes; rock at a depth of 2 to 5 feet.	Moderately deep to deep soils; moderate water-holding capacity; rapid intake rate; steep slopes.	Severe: Slopes of more than 15 percent; bedrock at a depth of 2 to 5 feet.
Moderate permeability in subsoil; moderate shrink-swell potential; slopes of more than 15 percent; bedrock at a depth of 2 to 5 feet.	Moderate strength; subject to piping and cracking; moderate shrink-swell potential; bedrock at a depth of 2 to 5 feet or more.	Moderate permeability; granite at a depth of 2 to 5 feet or more; steep slopes.	Moderately deep to deep soils; steep slopes; other features favorable.	Severe: Moderate permeability in subsoil; slopes of more than 15 percent; bedrock at a depth of 2 to 5 feet or more.
Moderate shrink-swell potential.	Moderate strength; subject to piping and cracking; moderate shrink-swell potential.	Moderately slow permeability.	Most features favorable.	Severe: Moderately slow permeability in subsoil; slopes of 9 percent.
High shrink-swell potential; slopes of more than 15 percent; bedrock at a depth of 1½ to 3½ feet.	Very low strength; cracks when dry; high shrink-swell potential; bedrock at a depth of 1½ to 3½ feet; stones throughout.	Slow permeability; stones throughout profile; bedrock at a depth of 1½ to 3½ feet; steep slopes.	Moderately deep soil; very slow intake rate; steep slopes.	Severe: Slow permeability; slopes of more than 15 percent; bedrock at a depth of 1½ to 3½ feet.
Slopes of more than 15 percent bedrock at a depth of ½ to 1½ feet.	Moderate strength; subject to piping and cracking; bedrock at a depth of ½ to 1½ feet.	Rapid permeability; bedrock at a depth of ½ to 1½ feet; steep slopes.	Shallow soils; moderate water-holding capacity; steep slopes.	Severe: Slopes of more than 15 percent; bedrock at a depth of ½ to 1½ feet.
High shrink-swell potential; water table at a depth of 3 to 4 feet.	Very low strength; cracks when dry; high shrink-swell potential.	Slow permeability; water table at a depth of 3 to 4 feet.	Slow intake rate; drainage required.	Severe: Slow permeability; water table at a depth of 3 to 4 feet.
High shrink-swell potential; slopes of more than 9 percent; bedrock at a depth of 2 to 5 feet.	Very low strength; cracks when dry; high shrink-swell potential; bedrock at a depth of 2 to 5 feet.	Slow permeability; rock at a depth of 2 to 5 feet; steep slopes.	Moderately deep soils; slow intake rate; steep slopes.	Severe: Slow permeability; slopes of more than 9 percent; bedrock at a depth of 2 to 5 feet.
Very slow permeability in clay subsoil; high shrink-swell potential; slopes of 5 to 15 percent.	Moderate to low strength; subject to piping and cracking; high shrink-swell potential.	Very slow permeability; slopes of 5 to 15 percent.	Very slow permeability in subsoil; slopes of 5 to 15 percent.	Severe: Very slow permeability in subsoil; slopes of 5 to 15 percent or more.
Moderate shrink-swell potential.	Low strength; cracks when dry; moderate shrink-swell potential.	Moderately slow permeability.	Most features favorable	Severe: Moderately slow permeability; slopes of 2 to 9 percent.
Sand subsoil	High strength; subject to piping and cracking.	Rapid permeability	Low water-holding capacity; rapid intake rate.	Slight to moderate: Slopes as great as 9 percent.
Very slow permeability in clay subsoil; high shrink-swell potential.	Low strength; subject to piping and cracking; high shrink-swell potential.	Very slow permeability; slopes of 2 to 30 percent.	Shallow over claypan; low water-holding capacity; moderately steep slopes in some places.	Severe: Very slow permeability in subsoil.
High shrink-swell potential.	Very low strength; cracks when dry; high shrink-swell potential.	Slow permeability	Slow intake rate	Severe: Slow permeability.

TABLE 5.—*Engineering interpretations*

Soil series and map symbols[1]	Suitability as source of—		
	Topsoil	Sand and gravel	Road fill
Diablo: DaD, DaE2, DaF2, DaG3, DlD, DlE2, DlF2. (For interpretations of Linne soils in mapping units DlD, DlE2, and DlF2, refer to the Linne series.)	Poor	Unsuitable	Poor
Docas: DoA, DoC, DsA, DsC	Poor	Unsuitable	Fair
Edenvale: EcA	Poor	Unsuitable	Poor
Gaviota: GaE, GaE2, GaF2, GrF2	Poor	Poor	Good
Gazos: GtE2, GtF2, GtG3, GsD	Fair	Unsuitable	Fair
Hanford: HaA, HaC, HfA, HfC	Good	Unsuitable	Good to fair
Henneke: HnF2, HsG3	Poor	Poor	Poor
Kettleman: KeD, KeF2, KmF2	Poor	Unsuitable	Fair
Laniger: LaG3	Fair	Fair	Good
Linne: LnD, LnE2, LnF2, LnF3, LsE2, LsF2. (For interpretations of Shedd soils in mapping units LsE2 and LsF2, refer to the Shedd series.)	Poor	Unsuitable	Fair
Lodo: LtG2	Poor	Unsuitable	Poor
Los Banos: LuC, LuD2, LuF3	Poor	Unsuitable in surface layer and subsoil; unsuitable in substratum.	Poor
Los Gatos: LvE, LvF2, LwF2	Fair	Unsuitable	Fair

See footnote at end of table.

of soils—Continued

Soil features affecting—				Soil limitations for use as septic tank filter field
Road location	Water-retention structures		Irrigation	
	Embankments	Reservoir area		
High shrink-swell potential; slopes of more than 9 percent; bedrock at a depth of 2½ to 6 feet or more.	Very low strength; cracks when dry; high shrink-swell potential; bedrock at a depth of 2½ to 6 feet or more.	Slow permeability; bedrock at a depth of 2½ to 6 feet or more; steep slopes.	Deep soils; slow intake rate; steep slopes.	Severe: Slow permeability; slopes of more than 9 percent; bedrock at a depth of 2½ to 6 feet.
Moderate shrink-swell potential.	Moderate strength; subject to piping and cracking; moderate shrink-swell potential.	Moderate permeability	Highly calcareous soils; other features favorable.	Moderate: Moderate permeability; slopes of as much as 9 percent.
High shrink-swell potential.	Very low strength; cracks when dry; high shrink-swell potential.	Slow permeability	Slow intake rate	Severe: Slow permeability.
Slopes of more than 15 percent; bedrock at a depth of ½ to 2 feet.	Moderate strength; subject to piping; bedrock at a depth of ½ to 2 feet.	Moderate permeability; bedrock at a depth of ½ to 2 feet; steep slopes.	Shallow soils; low water-holding capacity; steep slopes.	Severe: Slopes of more than 9 percent; bedrock at a depth of ½ to 2 feet.
Moderate shrink-swell potential; slopes of more than 15 percent; bedrock at a depth of 2 to 5 feet.	Moderate strength; moderate shrink-swell potential; bedrock at a depth of 2 to 5 feet.	Moderately slow permeability; bedrock at a depth of 2 to 5 feet; steep slopes.	Moderately deep to to deep soils; slow intake rate; steep slopes.	Severe: Moderately slow permeability; slopes of more than 9 percent; bedrock at a depth of 2 to 5 feet.
Most features favorable.	Moderate strength; subject to piping and cracking; low shrink-swell potential.	Rapid permeability	Most features favorable	Slight on slopes of 0 to 5 percent; moderate on slopes of 5 to 9 percent: Rapid permeability.
Low shrink-swell potential; slopes of more than 15 percent; bedrock at a depth of 1½ to 2 feet.	High to moderate strength; subject to piping; low shrink-swell potential; rock at a depth of 1½ to 2 feet.	Moderately slow permeability; bedrock at a depth of 1½ to 2 feet; steep slopes.	Shallow soils; low water-holding capacity; steep slopes.	Severe: Moderately slow permeability; slopes of more than 9 percent; bedrock at a depth of 1½ to 2 feet.
Low shrink-swell potential; slopes of more than 15 percent; bedrock at a depth of 2½ to 5 feet.	Moderate strength; subject to piping and cracking; low shrink-swell potential; bedrock at a depth of 2½ to 5 feet.	Moderate permeability; bedrock at a depth of 2½ to 5 feet; steep slopes.	Moderately deep to deep soils; steep slopes.	Moderate on slopes of 5 to 10 percent; severe on slopes of more than 10 percent: Moderate permeability; bedrock at a depth of 2½ to 5 feet.
Gravelly soils; slopes of more than 30 percent; bedrock at a depth of 1½ to 4 feet.	High strength; subject to piping and cracking; bedrock at a depth of 1½ to 4 feet.	Rapid permeability; bedrock at a depth of 1½ to 4 feet; steep slopes.	Moderately deep soils; rapid intake rate; low water-holding capacity; steep slopes.	Severe: Slopes of more than 30 percent; bedrock at a depth of 1½ to 4 feet.
Moderate shrink-swell potential; slopes of more than 9 percent; bedrock at a depth of 2 to 5 feet.	Low strength; moderate shrink-swell potential; bedrock at a depth of 2 to 5 feet.	Moderately slow permeability; bedrock at a depth of 2 to 5 feet; steep slopes.	Moderately deep soils; steep slopes.	Severe: Moderately slow permeability; slopes of more than 9 percent; bedrock at a depth of 2 to 5 feet.
Shaly soils; slopes of more than 50 percent; bedrock at a depth of 1 to 1½ feet.	Moderate strength; subject to piping and cracking; bedrock at a depth of 1 to 1½ feet.	Moderately rapid permeability; bedrock at a depth of 1 to 1½ feet; steep slopes.	Shallow soils; low water-holding capacity; steep slopes.	Severe: Moderately rapid permeability; slopes of more than 50 percent; bedrock at a depth of 1 to 1½ feet.
Slow permeability in subsoil; high shrink-swell potential; slopes of more than 15 percent in some places.	Low strength; cracks when dry; high shrink-swell potential.	Slow permeability; steep slopes in some places.	Slow permeability in subsoil; steep slopes in some places.	Severe: Slow permeability in subsoil.
Moderate shrink-swell potential; slopes of more than 15 percent; bedrock at a depth of 1½ to 5 feet.	Low strength; cracks when dry; moderate shrink-swell potential; bedrock at a depth of 1½ to 5 feet.	Moderately slow permeability; bedrock at a depth of 1½ to 5 feet.	Moderately deep soils; steep slopes.	Severe: Moderately slow permeability; slopes of more than 15 percent; bedrock at a depth of 1½ to 5 feet.

TABLE 5.—*Engineering interpretations*

Soil series and map symbols [1]	Suitability as source of—		
	Topsoil	Sand and gravel	Road fill
Metz:			
MeA	Poor	Poor in surface layer; good in substratum.	Good
MgA, MgC	Poor	Good	Good
MhA	Poor	Fair in surface layer and subsoil; unsuitable below a depth of about 50 inches.	Good
Mocho:			
MoA, MoC, MrB	Poor	Fair to poor	Good
MpA, MpC	Poor	Unsuitable	Good
MsC	Poor	Unsuitable	Fair
Montara: MtF2	Poor	Unsuitable	Poor
Nacimiento: NaD, NaE, NaF2, NaG2, NcG3	Poor	Unsuitable	Fair
Pacheco:			
Pa, Pc	Poor	Unsuitable	Fair
Pd	Poor	Unsuitable	Fair in surface layer; poor below.
Pe	Poor	Unsuitable	Poor in surface layer; fair below.
Panhill: PhC	Fair to poor	Unsuitable in surface layer; good in substratum.	Fair in surface layer and subsoil; good in substratum.
Panoche: PlA, PlC, PkA, PkC	Poor	Unsuitable	Fair
Pinnacles: PnE2, PnG3	Poor	Unsuitable	Good in surface layer; poor in subsoil.
Pinto: PsE2	Fair	Poor	Good

See footnote at end of table.

of soils—Continued

Soil features affecting				Soil limitations for use as septic tank filter field
Road location	Water-retention structures		Irrigation	
	Embankments	Reservoir area		
Sand substratum	High strength; subject to piping and cracking.	Rapid permeability	Rapid intake rate low water-holding capacity.	Slight: Most features favorable.
Gravelly soils; sandy substratum.	High strength; subject to piping and cracking.	Rapid permeability	Rapid intake rate; low water-holding capacity.	Moderate: Slopes of as much as 9 percent; flooding hazard.
Water table at a depth of 2 to 5 feet or more.	Moderate strength; subject to piping and cracking.	Moderately rapid to rapid permeability; water table at a depth of 2 to 5 feet or more.	Rapid intake rate; low water-holding capacity; drainage required.	Moderate: Water table at a depth of 2 to 5 feet or more.
Most features favorable; MrB gravelly throughout.	Moderate strength; subject to piping and cracking.	Moderately rapid permeability.	Most features favorable	Moderate: Slopes as great as 9 percent; flooding hazard.
Moderate shrink-swell potential.	Moderate strength; subject to piping and cracking; moderate shrink-swell potential.	Moderate permeability	Most features favorable	Moderate: Moderate permeability; slopes as of much as 9 percent.
Moderate shrink-swell potential.	Low strength; cracks when dry; moderate shrink-swell potential.	Moderately slow permeability.	Most features favorable	Severe: Moderately slow permeability; slopes of more than 9 percent.
Moderate shrink-swell potential; slopes of more than 9 percent; bedrock at a depth of ½ to 1½ feet.	Low strength; cracks when dry; moderate shrink-swell potential; bedrock at a depth of ½ to 1½ feet.	Moderately slow permeability; rock at a depth of ½ to 1½ feet; steep slopes.	Shallow soils; low water-holding capacity; steep slopes.	Severe: Moderately slow permeability; slopes of more than 15 percent; bedrock at a depth of ½ to 1½ feet.
Moderate shrink-swell potential; slopes of more than 15 percent; bedrock at a depth of 2 to 5 feet.	Low strength; cracks when dry; moderate shrink-swell potential; bedrock at a depth of 2 to 5 feet.	Moderately slow permeability; bedrock at a depth of 2 to 5 feet; steep slopes.	Moderately deep to deep soils; steep slopes.	Severe: Moderately slow permeability; slopes of more than 9 percent; bedrock at a depth of 2 to 5 feet.
Moderate shrink-swell potential; water tnble at a depth of 3 to 5 feet.	Moderate strength; subject to piping; moderate shrink-swell potential.	Moderately slow permeability; water table at a depth of 3 to 5 feet.	Drainage required; slightly to highly saline.	Severe: Moderately slow permeability; water table at a depth of 3 to 5 feet.
Moderate to high shrink-swell potential; water table at depth of 3 to 5 feet.	Low strength; cracks when dry; moderate to high shrink-swell potential.	Slow permeability; water table at a depth of 3 to 5 feet.	Slow permeability in subsoil; drainage required; slightly to highly saline.	Severe: Slow permeability; water table at a depth of 3 to 5 feet.
Moderate to high shrink-swell potential; water table at a depth of 3 to 5 feet.	Low strength; cracks when dry; moderate to high shrink-swell potential.	Slow permeability; water table at a depth of 3 to 5 feet.	Slow intake rate; drainage required; slightly to highly saline.	Severe: Slow permeability; water table at a depth of 3 to 5 feet.
Moderate shrink-swell potential; gravel below a depth of 60 inches.	Moderate strength; subject to piping and cracking; moderate shrink-swell potential.	Moderate permeability	Most features favorable	Moderate: Moderate permeability; slopes of as much as 9 percent.
Moderate shrink-swell potential.	Moderate strength; subject to piping and cracking; moderate. shrink-swell potential.	Moderate permeability	Most features favorable	Moderate: Moderate permeability; slopes of as much as 9 percent.
Slopes of more than 15 percent; bedrock at a depth of 2 to 4 feet.	Moderate to low strength; subject to piping and cracking; bedrock at a depth of 2 to 4 feet.	Slow permeability; bedrock at a depth of 2 to 4 feet; steep slopes.	Moderately deep to deep soils; steep slopes.	Severe: Slow permeability in subsoil; slopes of more than 15 percent; bedrock at a depth of 2 to 4 feet.
Slopes of more than 15 percent hardpan at a depth of 2 to 3 feet.	Moderate strength; subject to piping and cracking.	Hardpan at a depth of 2 to 3 feet; steep slopes.	Moderately deep soils; moderate water-holding capacity; steep slopes.	Severe: Slopes of more than 15 percent; hardpan at a depth of 2 to 3 feet.

TABLE 5.—*Engineering interpretations*

Soil series and map symbols [1]	Suitability as source of—		
	Topsoil	Sand and gravel	Road fill
Pleasanton:			
PtB	Fair in surface layer and subsoil; poor in substratum.	Unsuitable in surface layer and subsoil; fair in substratum.	Fair in surface layer and subsoil; good in substratum.
PvC2	Fair in surface layer and subsoil; poor in substratum.	Poor in surface layer and subsoil; fair in substratum.	Fair in surface layer and subsoil; good in substratum.
Reiff: ReA, ReC	Fair in surface layer; poor in substratum.	Poor in surface layer; unsuitable in substratum.	Good in surface layer; fair in substratum.
Rincon: RsA, RsC, RsD2, RnA, RnC, RnD2	Fair in surface layer: poor in subsoil and substratum.	Unsuitable	Fair in surface layer and substratum; poor in subsoil.
Salinas: SaA, SaC	Fair to poor	Unsuitable	Fair
San Benito: SbD, SbE2, SbF2, SbF3	Fair to poor	Unsuitable	Fair
Santa Lucia: SdF2, SdG3	Poor	Fair to poor	Good
Shedd: ShD, ShE2, ShF2, ShF3	Poor	Unsuitable	Fair
Sheridan: SkD, SkE, SkE2, SkG2, SkG3	Fair	Poor	Good
Soper: SmD, SmE2, SmF2, SID, SIE2, SIF2	Fair in surface layer and subsoil; poor in substratum.	Unsuitable in surface layer and subsoil; fair to poor in substratum.	Fair
Sorrento:			
SnA, Snc	Fair to poor	Unsuitabe	Fair
SoB	Fair to poor	Poor	Fair
SrA, SrC	Poor	Unsuitable	Fair

See footnote at end of table.

of soils—Continued

Soil features affecting				Soil limitations for use as septic tank filter field
Road location	Water-retention structures		Irrigation	
	Embankments	Reservoir area		
Moderate shrink-swell potential.	Low strength; subject to piping and cracking; moderate shrink-swell potential.	Moderately slow permeability.	Most features favorable.	Severe: Moderately slow permeability in subsoil.
Gravelly soils; moderate to low shrink-swell potential.	Low strength; subject to piping and cracking; moderate to low shrink-swell potential.	Moderately slow permeability.	Most features favorable.	Severe: Moderately slow permeability in subsoil.
Low to moderate shrink-swell potential.	Moderate strength; subject to piping and cracking.	Moderately rapid permeability.	Most features favorable.	Moderate: Moderate permeability in substratum; slopes of more than 9 percent.
Slowly permeable; clay subsoil; high shrink-swell potential.	Very low strength; cracks when dry; high shrink-swell potential.	Slow permeability; strongly sloping in some places.	Slowly permeable subsoil; steep slopes in some places.	Severe: Slowly permeable in subsoil; slopes of more than 9 percent in some places.
Moderate shrink-swell potential.	Low strength; cracks when dry; moderate shrink-swell potential.	Moderately slow permeability.	Most features favorable.	Severe: Moderately slow permeability; slopes of as much as 9 percent.
Moderate shrink-swell potential; slopes of more than 9 percent; bedrock at a depth of 2 to 4 feet.	Low strength; cracks when dry; moderate shrink-swell potential; bedrock at a depth of 2 to 4 feet.	Moderately slow permeability; bedrock at a depth of 2 to 4 feet; steep slopes.	Moderately deep soils; steep slopes.	Severe: Moderately slow permeability; slopes of more than 9 percent.
Low shrink-swell potential; slopes of more than 30 percent; bedrock at a depth of 1½ to 3½ feet.	High to moderate strength; subject to piping and cracking; low shrink-swell potential; bedrock at a depth of 1½ to 3½ feet.	Moderately rapid permeability; bedrock at a depth of 1½ to 3½ feet; steep slopes.	Moderately deep soils; rapid intake rate; low water-holding capacity; steep slopes.	Severe: Slopes of more than 30 percent; bedrock at a depth of 1½ to 3½ feet.
Moderate shrink-swell potential; slopes of more than 9 percent; bedrock at a depth of 1½ to 3½ feet.	Moderate strength; subject to piping and cracking; moderate shrink-swell potential; bedrock at a depth of 1½ to 3½ feet.	Moderate permeability; stones in substratum; bedrock at a depth of 1½ to 3½ feet; steep slopes.	Moderately deep soils; steep slopes.	Severe: Moderate permeability; slopes of more than 9 percent; bedrock at a depth of of 1½ to 3½ feet.
Slopes of more than 15 percent; bedrock at a depth of 1½ to 5 feet.	Moderate strength; subject to piping and cracking; bedrock at a depth of 1½ to 5 feet or more.	Moderately rapid permeability; bedrock at a depth of 1½ to 5 feet or more; steep slopes.	Moderately deep to deep soils; moderate water-holding capacity; steep slopes.	Severe: Slopes of more than 9 percent; bedrock at a depth of 1½ to 5 feet or more.
Low shrink-swell potential; slopes of more than 9 percent; bedrock at a depth of 2½ to 4 feet.	Low strength; subject to piping and cracking; low shrink-swell potential; bedrock at a depth of 2½ to 4 feet.	Moderately slow permeability; bedrock at a depth of 2½ to 4 feet; steep slopes.	Moderately steep slopes.	Severe: Moderately slow permeability in subsoil; slopes of more than 9 percent; bedrock at a depth of 2½ to 4 feet.
Moderate shrink-swell potential.	Moderate strength; subject to piping and cracking; moderate shrink-swell potential.	Moderate permeability.	Most features favorable.	Moderate: Moderate permeability; slopes of as much as 9 percent.
Gravelly soils; low shrink-swell potential.	Moderate strength; subject to piping and cracking; low shrink-swell potential.	Moderate permeability.	Most features favorable.	Moderate: Moderate permeability.
Moderate shrink-swell potential.	Low strength; cracks when dry; moderate shrink-swell potential.	Moderately slow permeability.	Most features favorable.	Severe: Moderately slow permeability; slopes of as much as 9 percent.

TABLE 5.—*Engineering interpretations*

Soil series and map symbols [1]	Suitability as source of— Topsoil	Suitability as source of— Sand and gravel	Suitability as source of— Road fill
Sween:			
SsE2, SsF2	Poor	Unsuitable	Fair in surface layer; poor in subsoil.
StE2, SwF2	Poor	Unsuitable	Poor
Vallecitos: VaD, VaE, VaF, VaF2, VrE2, VrF2	Poor	Unsuitable in surface layer and subsoil.	Fair to poor
Willows: Wc, Wk, Ws, Ww2	Poor	Unsuitable	Poor
Yolo:			
YoA, YoC	Fair to good	Unsuitable in surface layer and substratum.	Fair
YvB	Fair to good	Poor	Fair to good

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[1] Because their properties vary, interpretations were not made for Badland (BaG), Gullied land (GuE), Igneous rock land (IgG), Landslides (LdF), Mine pits and dumps (MnG), Riverwash (Rw), Sandy alluvial land (Sc), Sedimentary rock land (SeG), Terrace escarpments (TeF).

TABLE 6.—*Engineering*

Soil name and location	Parent material	California report No.	Depth	Horizon	Moisture-density [2] Maximum dry density	Moisture-density [2] Optimum moisture	Mechanical analysis [3] Percentage passing sieve— 3 in.	¾ in.	⅜ in.
		V62	*Inches*		*Lb. per cu. ft.*	*Percent*			
Antioch loam:									
400 yards E. of Basarich ranch-house on McMahan Road.	Stratified sand, silt, and clay; gravelly in some places.	5005	0–10	Ap	123	11	------	------	------
		5006	13–25	B21t	106	15	------	------	------
		5007	54–76	IIIC2	115	16	------	------	------
Arnold loamy sand:									
100 yards N. and 30 yards W. of the end of Rea Road.	Sandstone.	5019	0–12	Ap	126	9	------	------	------
		5020	12–22	C1	131	9	------	------	------
		5021	22–46	C2	130	10	------	------	------
		5022	46–90	C3	129	10	------	------	------

See footnotes at end of table.

of soils—Continued

Soil features affecting—				Soil limitations for use as septic tank filter field
Road location	Water-retention structures		Irrigation	
	Embankments	Reservoir area		
Slow permeability in clay subsoil; moderate to high shrink-swell potential; slopes of more than 15 percent; bedrock at a depth of 1½ to 4 feet.	Low strength; cracks when dry; moderate to high shrink-swell potential; bedrock at a depth of 1½ to 4 feet.	Slow permeability; bedrock at a depth of 1½ to 4 feet; steep slopes.	Moderately deep soils; slow intake rate; steep slopes.	Severe: Slow permeability in clay subsoil; slopes of more than 15 percent; bedrock at a depth of 1½ to 4 feet.
Slow permeability in clay subsoil; low shrink-swell potential; slopes of more than 15 percent; bedrock at a depth of 1½ to 2½ feet.	Very slow strength; cracks when dry; low shrink-swell potential; bedrock at a depth of 1½ to 2½ feet.	Slow permeability; bedrock at 1½ to 2½ feet; stones and rocks; steep slopes.	Shallow soils; slow intake rate; steep slopes.	Severe: Slow permeability in subsoil; slopes of more than 15 percent; bedrock at a depth of 1½ to 2½ feet.
Slow permeability in clay subsoil; moderate shrink-swell potential; slopes of more than 9 percent; bedrock at a depth of 1 to 3 feet.	Moderate to low strength; subject to piping and cracking; moderate shrink-swell potential; bedrock at a depth of 1 to 3 feet.	Slow permeability; bedrock at 1 to 3 feet; steep slopes; rock outcrops.	Shallow soils; slowly permeable subsoil; steep slopes.	Severe: Slow permeability in clay subsoil; slopes of more than 9 percent; bedrock at a depth of 1 to 3 feet.
High shrink-swell potential; water table at a depth of 1½ to 3 feet.	Very low strength; cracks when dry; high shrink-swell potential.	Very slow permeability; water table at a depth of 1½ to 3 feet.	Slow intake rate; drainage required; slightly to highly saline.	Severe: Very slow permeability; water table at a depth of 1½ to 3 feet.
Moderate shrink-swell potential; gravelly below a depth of 40 inches.	Moderate strength; subject to piping and cracking; moderate shrink-swell potential.	Moderate permeability	Most features favorable	Moderate: Moderate permeability; slopes of as much as 9 percent.
Low shrink-swell potential; gravelly soils.	Moderate strength; subject to piping and cracking; low shrink-swell potential.	Moderate permeability	Most features favorable	Slight to moderate: Moderate permeability.

test data [1]

Mechanical analysis[3]—Continued								Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued				Percentage smaller than—						AASHO[4]	Unified[5]
No.4 (4.7 mm.)	No.10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
100	99	94	73	68	45	24	19	23	8	A-4(8)	CL
-------	100	97	83	81	64	51	45	53	29	A-7-6(18)	CH
-------	100	96	75	71	48	29	20	40	20	A-6(12)	CL
-------	100	80	27	26	20	10	6	[6] NP	[6] NP	A-2-4(0)	SM
-------	100	85	33	31	23	12	8	NP	NP	A-2-4(0)	SM
100	99	80	24	23	19	13	9	NP	NP	A-2-4(0)	SM
-------	100	80	24	23	19	13	11	NP	NP	A-2-4(0)	SM

TABLE 6.—*Engineering*

Soil name and location	Parent material	California report No.	Depth	Horizon	Moisture-density[2]		Mechanical analysis[3]		
					Maximum dry density	Optimum moisture	Percentage passing sieve—		
							3 in.	¾ in.	⅜ in.
		V62	*Inches*		*Lb. per cu. ft.*	*Percent*			
Clear Lake clay: 30 yards E., of intersection of San Felipe Road and State Route 156.	Stratified alluvium.	5008	0–12	Ap	101	19	------	------	------
		5009	12–30	A1	106	13	------	------	------
		5010	40–70	C2	105	19	------	------	------
Gaviota loam: 300 yards N. of Clear Creek Road and 0.75 mile from Hernandez valley.	Sandstone and sandy shale.	5011	0–7	A1	111	16	------	------	------
		5012	7–19	C1	118	14	100	98	90
Henneke fine gravelly loam: 1 mile N. of Clear Creek by Clear Creek and New Idria Road.	Serpentine.	5013	0–3	A	97	23	100	97	95
		5014	3–11	B2t	103	21	100	99	95
		5015	11–25	C	108	19	------	100	95
Kettleman loam: 2 miles N. of Ashurst oil lease road on New Idria Road and 0.25 mile W. of Cedar Flats.	Sandstone.	5017	10–22	A12	105	19	------	------	------
		5018	22–41	C1	106	19	------	------	------
Pacheco silt loam: 50 yards N. of Pacheco School on the NW. corner of Shore Road and Lovers Lane.	Stratified alluvium.	5023	9–20	A12	116	14	------	------	------
		5024	32–64	C2g	116	14	------	------	------
Panoche loam: 400 yards SE. of Recalde ranchhouse.	Stratified alluvium.	5025	0–8	Ap	118	14	------	------	------
		5026	12–29	Cl	110	15	------	------	------
		5027	39–76	C3	110	14	------	------	------
Pinnacles coarse sandy loam: 0.5 mile E. of Jef Schmidt ranchhouse and 300 yards W. of main ranch road.	Arkosic sandstone.	5028	0–8	A11	128	9	100	98	97
		5029	12–22	B2t	116	14	------	100	99
		5030	25–60	C	127	10	------	100	99
Rincon silty clay loam: 600 yards E. of house on Young Ranch and 200 yards N. of stream.	Stratified alluvium.	5031	0–12	Ap	111	15	------	------	------
		5032	33–45	B22t	107	18	------	------	------
		5033	45–80	Cca	100	20	------	------	------
San Benito clay loam: 40 yards N. of Willow Creek Road and 0.5 mile S. of Morelini ranchhouse	Sandstone and shale.	5001	8–20	A12	112	15	------	------	------
		5002	20–35	C1	112	15	------	------	------
		5003	35–45	Cca	114	15	------	------	------
Shedd loam: 30 yards E. of King City Road and 4 miles SW. of Bitterwater store.	Sandstone.	5034	3–12	A12	98	22	------	------	------
		5035	20–32	IIC1	92	26	------	------	------
Vallecitos loam: 20 yards N. of ranch road and 0.5 mile N. of ranchhouse.	Metamorphosed sandstone.	5041	0–6	A1	127	10	------	100	97
		5042	17–32	B2t	117	13	100	99	98
Willows clay: 60 yards N. of Bolsa Road and 0.25 mile W. of Shore Road.	Stratified alluvium.	5038	0–12	Ap	100	17	------	------	------
		5039	19–33	A12	109	16	------	------	------
		5040	33–57	C1	109	16	------	------	------

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[1] Tests performed by District V, California Division of Highways, in accordance with procedures given in "California Materials Manual for Testing and Control Procedures" (*3*).

[2] Based on method of test for relative compaction of untreated and treated soils and aggregates, test method No. Calif. 216E (*3*).

[3] Mechanical analyses by the procedure of California Division of Highways. Results by this procedure frequently may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the California procedure, the fine material is analyzed by the hydrometer method and the various grain-sized fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the

test data [1]—Continued

Mechanical analysis [3]—Continued								Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued				Percentage smaller than—						AASHO [4]	Unified [5]
No.4 (4.7 mm.)	No.10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
-------	100	99	95	94	82	56	45	58	30	A-7-6(20)	CH
-------	100	99	96	94	79	55	46	70	44	A-7-6(20)	CH-MH
-------	100	99	97	97	94	61	45	57	31	A-7-6(19)	CH
100	99	94	82	78	58	33	23	37	8	A-4(8)	ML
75	65	86	48	46	35	20	13	36	10	A-4(3)	SM-SC
92	83	55	32	30	21	12	9	NP	NP	A-2-4(0)	SM
89	79	52	32	31	25	18	16	51	19	A-2-7(2)	SM
89	78	53	28	25	20	13	12	43	9	A-2-5(0)	SM
100	99	94	57	50	30	14	11	33	4	A-4(4)	ML
100	98	92	57	49	29	17	11	32	5	A-4(4)	ML
-------	100	98	90	86	56	32	25	36	7	A-4(8)	ML
100	99	98	92	90	66	40	29	35	13	A-6(9)	ML-CL
-------	100	99	74	68	44	26	21	29	8	A-4(8)	ML-CL
100	93	60	35	32	25	16	11	34	13	A-2-6(1)	SC
-------	100	97	80	75	56	35	24	35	24	A-6(10)	CL
94	87	54	27	25	17	8	6	NP	NP	A-2-4(0)	SM
98	92	71	55	53	49	42	38	52	30	A-7-6(13)	CH
96	87	51	20	19	15	10	8	27	6	A-2-4(0)	SM-SC
-------	-------	100	88	86	65	47	39	45	26	A-7-6(15)	CL
-------	-------	100	89	85	66	46	42	51	30	A-7-6(18)	CH
100	98	92	73	62	31	13	8	36	8	A-4(8)	ML
100	99	95	71	68	52	35	30	41	21	A-7-6(12)	CL
100	99	95	71	67	52	37	27	40	19	A-6(11)	CL
100	99	92	65	62	48	31	24	37	17	A-6(9)	CL
100	98	92	53	50	35	22	15	31	4	A-4(4)	ML
100	93	83	46	43	31	18	12	35	7	A-4(2)	SM
91	83	65	48	46	38	25	16	33	10	A-4(3)	SM-SC
94	88	72	59	58	52	40	32	53	28	A-7-6(14)	CH
-------	-------	100	98	98	83	63	52	64	36	A-7-6(20)	CH
-------	100	98	94	92	82	81	81	63	39	A-7-6(20)	CH
-------	100	99	98	97	84	52	41	44	23	A-7-6(14)	CL

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material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable in naming textural classes for soil.

[4] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8). The classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHO Designation M 145-49 (*1*).

[5] Based on the Unified Soil Classification System, Tech. Memo. No. 3-357, v. 1, Waterways Experiment Station. Corps of Engineers, March 1953 (*10*). Soils that have a plasticity index within 2 points of A-line are to be given a borderline classification. Examples of borderline classification thus obtained are ML-CL, SM-SC, and CH-MH.

[6] NP=Nonplastic.

Engineering classification systems

Two systems of classifying soils are in general use among engineers. One is the system approved by the American Association of State Highway Officials (AASHO) (*1*), and the other is the Unified system adopted by the Corps of Engineers, U.S. Army (*10*). Both systems are used in this survey and are explained in the following paragraphs. The explanations are taken largely from the PCA Soil Primer (*4*).

AASHO classification system.—Most highway engineers classify soil material according to the AASHO system. In this system soil material is classified in seven principal groups. These groups range from A–1 (gravelly soils of high bearing capacity, the best soils for subgrade) to A–7 (clay soils having low strength when wet, the poorest for subgrade). Within each group, the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best material to 20 for the poorest. For the soils tested, the group index numbers are shown in table 6 in parentheses following the soil group symbol. The estimated AASHO classification of the soils in the county, without group index numbers, is given in table 4.

Unified classification system.—The Unified system identified materials as coarse grained, eight classes; fine grained, six classes; and highly organic. The tested soils are classified according to the Unified system in table 6, and the classification for the soils that were not tested is estimated in table 5.

Estimated engineering properties of soils

Table 4 provides estimates of important properties of soils that affect engineering. The estimates in this table are based on the results of laboratory tests given in table 6, on experience with similar soils in other areas, and on information in other parts of this survey.

Depth to the seasonally high water table is not given in table 4, because the water table is below a depth of 5 feet for most soils in the county. In a few soils, however, the depth is less than 5 feet. The water table is at a depth of 1½ to 3 feet in the Willows soils, 2 to 5 feet in Metz sandy loam, wet variant, 3 to 4 feet in Clear Lake soils, 3 to 5 feet in Pacheco soils, and 5 feet in Edenvale soils.

Salinity is also not listed in table 4, because the soils of only three series—Clear Lake, Pacheco, and Willow—contain excessive amounts of soluble salts.

Because the properties estimated in table 4 are for a typical profile, some variations from the values given should be expected. A description of a profile representative of each series in the county is given in the section "Descriptions of the Soils."

Hydrologic soil groups are groups of soils having similar rates of infiltration when wetted and similar rates of water transmission within the soil. Four such groups currently are recognized.

Soils in group A have a high infiltration rate, even when thoroughly wetted. They have a high rate of water transmission and low runoff potential. The soils of this group are deep, are well drained or excessively drained, and consist chiefly of sand, gravel, or both.

Soils in group B have a moderate infiltration rate when thoroughly wetted. Their rate of water transmission and their runoff potential are moderate. These soils are moderately deep or deep, are moderately well drained or well drained, and are medium textured to moderately coarse textured.

Soils of group C have a slow infiltration rate when thoroughly wetted. Their rate of water transmission is slow, and their potential runoff is high. These soils have a layer that impedes the downward movement of water, or they are moderately fine textured or fine textured and have a slow infiltration rate.

Soils of group D have a slow infiltration rate when thoroughly wetted. Their rate of water transmission is very slow, and runoff potential is very high. In this group are (1) clay soils that have a high shrink-swell potential; (2) soils that have a permanent high water table; (3) soils that have a claypan or clay layer at or near the surface; and (4) soils that are shallow over nearly impervious material.

For each layer significant in engineering, table 4 lists the USDA textural classification and the Unified and AASHO engineering classifications.

The columns headed "Percentage passing sieve" list percentages of material that is small and passes the openings of a 3-inch sieve and No. 4, No. 10, No. 40, and No. 200 sieves. Material retained on the No. 200 sieve (0.074 millimeter) is generally considered coarse textured.

Soil permeability is the ability of a soil to transmit air or water. It is measured in terms of the rate at which water passes through the soil. In table 4 the column that shows permeability gives, in inches per hour, the estimated rate that water moves downward through the undisturbed soil.

The available water capacity, expressed in inches per inch of soil depth, is the capacity of a soil to retain water that can be readily absorbed by plants. It is essentially the amount of water held in a soil between field capacity and the permanent wilting point of plants.

The shrink-swell potential is an indication of the change in volume of the soil material that is expected when moisture content changes. It is estimated on the basis of the kind and amount of clay in the soil layers. In general soils classified as A–7 and CH have high shrink-swell potential. Clean sands and gravels and soils having a small amount of nonplastic to slightly plastic fines have a low shrink-swell potential.

Most materials, such as uncoated steel, corrode or deteriorate when buried in soil. The rate at which a material deteriorates depends largely on soil properties such as texture, drainage, total acidity, and electrical conductivity. Rated in the last column of table 4 is the potential corrosion of uncoated steel in each soil in the county.

Engineering interpretations of soils

In table 5 the soils of San Benito County are rated according to their suitability as a source of topsoil, sand and gravel, and road fill. Also indicated are those soil features that affect suitability as sites for roads, water-retention structures, and irrigation systems. The degree of limitation to the use of soil as filter fields for septic tanks also is shown.

Because the water table is below a depth of 5 feet in most soils of the county, agricultural drainage is not listed in table 5. Clear Lake, Pacheco, and Willows soils and Metz sandy loam, wet variant, have a water table above a depth of 5 feet and require some drainage.

The soils are rated as a source of topsoil for use on slopes, shoulders of roads, and along ditches. The soils are rated "good," "fair," "poor," or "unsuitable" according to their ability to support plants.

Some of the soil features that adversely affect the location of roads include texture, drainage, depth to bedrock or hardpan, high water table, slopes, and rockiness or stoniness.

Among the water-retention structures considered in table 5 are irrigation reservoirs, fish ponds, stock-water ponds, recreation lakes, and sewage lagoons. Soil features affecting both the floor, or impondment area, and the embankment need to be considered. Among the soil features affecting the floor are permeability, slope, depth to rock or water table, and drainage. The major soil features affecting embankment material are strength, piping, or subsurface erosion, cracking, shrink-swell potential, and depth to bedrock.

Suitability of a soil for irrigation is based chiefly on its water-holding capacity, rate of intake, slope, and depth. Also considered are barriers to the movement of air and water into the soils and salinity or alkalinity.

Ratings used to describe limitations to use of a soil as a filter field are "slight," "moderate," or "severe." These ratings are based on permeability, slope, depth to bedrock or water table, drainage, and hazard of flooding. A filter field is part of the septic tank soil absorption system for disposal of sewage on the site. It consists of subsurface tile lain in such a way that effluent from the septic tank is distributed with reasonable uniformity into the soil.

Engineering problems in San Benito County are complicated in areas of the San Andreas and associated faults. Along these faults, investigations of the site are required before work is planned.

Engineering test data

Table 6 contains test data for samples collected from selected soils and tested by the California Division of Highways. Tests were made to determine moisture density, liquid limit, and plasticity. A mechanical analysis of each sample was made so that the percentage of the various grain-size particles could be determined.

In the moisture-density, or compaction, test a sample of soil material is compacted several times using the same compactive effort, but each time at a higher content of moisture. The dry density, or unit weight, of the compacted material increases until the optimum moisture content is reached. After that, the dry density obtained in the compaction test is termed maximum dry density. Soil in earthwork is most stable if it is compacted to about maximum dry density when it is at the optimum moisture content.

The mechanical analysis data was determined by the sieve and hydrometer method. The data shows particle-size distribution for gravel, sand, silt, and clay. Tests for liquid limit and plastic limit measure the effect of water on the consistence of soil. As the moisture content of a clayey soil increases from a dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the soil material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil passes from a semisolid to a plastic state. The liquid limit is the moisture content at which the soil material changes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. A nonplastic soil is one that is granular or without cohesion and for which the liquid or plastic limit cannot be determined.

Formation and Classification of Soils

This section discusses the effects of the five factors of soil formation on the soils in San Benito County and describes important processes in the morphology of soils. Also, the current system of soil classification is explained, and each soil series represented in the county is placed in some categories in that system and in the great soil group of an older system.

Factors of Soil Formation

Soil is a natural body on the surface of the earth in which plants grow; it is composed of organic and mineral material. Soils differ in their appearance, composition, productivity, and management requirements in different localities or even within short distances in the same locality. The factors that cause soils to differ are (1) the physical and chemical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the living organisms; (4) the relief, or lay of the land, and (5) the length of time the forces of formation have acted on the soil material. The relative importance of each factor differs from place to place, but generally the interaction of all the factors determines the kind of soil that forms in any given place. The influence of each soil-forming factor on the soils in San Benito County is described in the pages that follow.

Parent material

Parent material in the unconsolidated mass from which a soil develops. It is largely responsible for the chemical and mineralogical composition of soils. In San Benito County the soils formed in residual and alluvial parent materials. Soils derived from residual material formed in place through weathering of the underlying rocks. Those formed in alluvial material occur in the valleys and along the major waterways of the county.

The residual parent material was derived from sandstone, sandstone conglomerate, shale, granite, basic igneous rock, serpentine, and soft formations that consist of stratified or mixed sand, gravel, and clay. Many of the sedimentary formations are limy, and the lime is generally retained by the material that developed from these formations and by the soils formed from the parent material. Granite weathers into fine gravelly or coarse sandy parent material. Much of the gravel or sand is quartz, which weathers very slowly. The soils formed from quartz are generally coarse textured.

Alluvial parent material is generally of local origin. It is washed from the geologic formations of the uplands that surround the valleys and along the major drainageways. The alluvium has mixed lithology because there are a wide variety of sedimentary, metamorphic, and igneous formations in the uplands.

In San Benito County the alluvium ranges widely in texture because it was deposited in different ways. Alluvium on fans and toe slopes generally have texture and other characteristics similar to those of the material in the hills immediately above them. The alluvium in the larger valleys has been laid down by streams when they were normal or flooding. As a stream overflows its channel and the water spreads over the flood plain, the coarser textured sediments are deposited first. The floodwaters continue to spread but they move more slowly and finer sediments, such as silt, are next deposited. The silt is commonly mixed with some sand and clay. Most of the clay is deposited when the flood has passed and the water is left standing in the lowest part of the flood plain. The clay particles do not settle until the water becomes still.

In the larger valleys the alluvium generally is laid down in a pattern in which loamy sand and sandy loam are near the streams, clay and silty clay are in the lowest parts of the flood plain, and loam, silt loam, and clay loam are between these two positions. An earlier cycle of deposition when the streams had different courses is suggested by many alluvial soils that have buried horizons at a depth of 40 to 80 inches, by some clayey soils that are underlain by sand at a depth of 40 to 80 inches, and by some loams and sandy loams that have clay layers at a depth of 60 to 100 inches. Geologic changes, not stream meandering, are believed to have caused streams to change their courses and begin a new cycle of erosion and deposition.

Areas of older alluvium occur as hillocks in the present flood plains, are at higher elevations between the flood plains and the hills, or are along the larger waterways. Generally, the soils formed in older alluvium are moderately to strongly developed, and in places they are dissected by drainageways.

Differences in the texture of the alluvium are generally accompanied by differences in chemical and mineralogical composition. The sandier sediments generally contain more quartz and less feldspars and ferromagnesian minerals than do the finer textured sediments and generally are more siliceous and lower in bases. In addition, the sandier sediments generally have less exchangeable sodium than the finer textured sediments, but there are some sandy alluvial areas that have a high water table and contain moderate to large amounts of sodium.

Climate

Climate as a genetic factor affects the physical, chemical, and biological relationships in soils, primarily through the influence of precipitation and temperature. Water dissolves minerals, supports biological activity, and transports mineral and organic residues through the soil. Temperature determines the kinds of physical, chemical, and biological activities that take place in the soil and determines the speed at which they act.

The soils in San Benito County formed in a Mediterranean climate that is generally semiarid but is subhumid in the northwestern part because of the cool moist air from the Pacific Ocean. Generally, climate has been a uniform factor in soil formation throughout the county.

Precipitation varies considerably from year to year. In some years the soils may be moistened only for a few feet, but in other years they are saturated to their full depth. Usually, the soils are moist and subject to some leaching from January through April and are dry to very dry from May through December. Winters are mild and the soils are not frozen, but frost may affect the top few inches.

The flood plains of the streams are geologically young and have not had time to be strongly weathered. Also, the sediments have come from sections of the county where weathering is not intense. For these reasons, soils formed in these materials show little development other than an accumulation of organic matter in the surface layer and some downward movement of carbonates.

Living organisms

In San Benito County, the living organisms that affect development of soils are micro-organisms, vegetation, animals, and man. Native vegetation was the most important of these before the county was settled. Large areas consisted of open grassland covered with perennial grasses. Many hilly and mountainous areas had open stands of oaks, Digger pine, and Coulter pine and there were some areas of brush. Cottonwoods and willows grew along the streams, and willows and swamp plants covered wet areas.

In general, differences in native vegetation on soils of the uplands seems to be associated with differences in parent materials; and differences in vegetation on soils of the flood plains, with differences in drainage. Open stands of Digger and Coulter pines grew on soils under lain by granite and serpentine, and brush grew where these soils were thin. A mixture of grasses, Digger pine, and oaks generally grew where the parent material was acid weathered sandstone and shale. Soils formed on calcareous sandstone and shale were grassland with open stands of oaks on north-facing slopes and along drainageways.

Since the county was settled and formed, man has caused changes in the native vegetation. Annual grasses have been substituted for perennial grasses; erosion has been accelerated; areas of brush have increased; and large areas have been cleared and cultivated. Swampy areas have been drained, and the water table has been lowered. Also, irrigation has greatly increased the amount of water passing through soils, and fertilization and crop removal have changed their chemical composition. Other than accelerated erosion, few results of these changes as yet are reflected in the development of soils. Some may not be evident for hundreds of years, but the activities of man have drastically changed the living organisms that affect soil formation.

Relief

Relief is largely determined by the underlying geologic formation, the geologic history of the region, and the effects of dissection by rivers and streams. Relief influences soil formation through its effects on drainage, erosion, temperature, and plant cover.

San Benito County is an area of valleys, hills, and mountains in the central coastal range of California. Elevations range from 120 feet above sea level on the Pajaro River in the north, to 5,248 feet on top of San

Benito Mountain in the southeastern end of the county. Drainage is northwestward and most of the county is drained by the San Benito River and its tributaries.

The upland areas are generally deeply dissected by drainage. This dissection has formed in long winding ridges that have relatively steep side slopes. Some of the ridgetops are broad and have slopes ranging from 10 to 25 percent. Other ridgetops, generally steep ones, are narrow and somewhat angular. Slopes in the uplands generally range from 30 to 70 percent, but large areas have slopes ranging from 45 to 60 percent. Some small upland valleys, mainly at the heads of drainageways, have slopes that range from 3 to 12 percent.

Most of the soils in the uplands are well drained, but on the very steep slopes drainage ranges to excessive. Geologic erosion is active in the uplands particularly on the steeper slopes over softer formations. Also, accelerated erosion has followed overgrazing, fires, and cultivation in many areas.

The flood plains in the larger valleys generally have slopes of 2 percent or less. Slopes are 2 to 9 percent in some areas, generally along major drainageways and on fans.

The flatness of the flood plains is partly responsible for the slow drainage of many areas, especially areas of slack-water clays. Runoff is slow to very slow, and movement of water through these clays is generally slow. This causes a high or fluctuating water table and a concentration of exchangeable sodium because the flood plain is flat and drainage outlets are lacking.

On the terraces many soils occur in large areas that have slopes of 1 to 3 percent. These soils are generally moderately well drained to well drained. The more poorly drained soils on terraces have a tight subsoil and slow or very slow movement of water through it.

Time

The age of a soil is usually related to the degree of development or degree of horizon differentiation within the soil. For this reason, a soil that has little or no development is considered young, while one that is strongly developed is considered old or mature. The age of any one soil is directly dependent on the action and interaction of the soil forming factors.

In San Benito County the oldest soils are on terraces and are moderately to strongly developed. These soils formed in old alluvium above the flood plains and are more stable than the soils on these plains.

The soils in more recent alluvium are generally young. Many of them are on fans or are close to major drainageways, and they receive sediments from the hills above or from stream overflow. In the larger valleys, however, many of the soils are no longer flooded and receive little or no sediments. These soils have been in place a relatively short time and show little or no development other than some downward movement of carbonates.

Soils in the uplands formed on metamorphosed sandstone and shale, granite, arkosic sandstone, and moderately hard sandstone. Some of these soils are moderately developed, but most are young and show little development other than the accumulation of organic matter in the surface layer and some leaching of carbonates.

Morphology

The morphology of soils in San Benito County generally is expressed by faint horizons in soils formed in alluvium and in many soils of the uplands and by distinct horizons in soils on terraces and in some soils of the uplands. The differentiation of horizons in soils is the result of one or more of the following processes: (1) Accumulation of organic matter, (2) leaching of carbonates and salts more soluble than calcium carbonate, (3) accumulation of exchangeable sodium and related salts, (4) translocation of silicate clay minerals, (5) stratification of parent material, and (6) reduction and transfer of iron. In most of the soils in the county, two or more of these processes have affected the development of horizons. For example, the accumulation of organic matter, leaching of carbonates, and stratification of the parent material are reflected in the faint horizons of Sorrento silt loam. The accumulation of organic matter, stratification of the parent material, and the reduction and transfer of iron are reflected in the morphology of Pacheco loam. All processes have operated to some extent in the horizon differentiation of Cotati loam.

Some organic matter has accumulated in the uppermost layer to form an A1 horizon in all the soils in San Benito County. Much of that organic matter is in the form of humus. The quantity ranges from very small in some soils to relatively large in others. Metz gravelly sandy loam and Los Banos clay loam are examples of soils that have faint A1 horizons and that are low in organic-matter content. Other soils, such as Pacheco silt loam, have a thick dark-colored A1 horizon that is moderately high in organic-matter content. The accumulation of organic matter has been the most important process in horizon differentiation in many of the soils in this county.

Leaching of carbonates and salts has occurred to some extent in most soils of the county, except perhaps in Metz gravelly sandy loam, Panoche sandy loam, and other soils in very recent alluvium. The degree of leaching varies considerably throughout the county. Sorrento silt loam, Salinas clay loam, and other soils are partly leached and have an accumulation of carbonates in the C horizon. Other soils, such as Antioch loam, are leached in the A horizon, but some carbonates remain in the B and C horizons. Sheridan coarse sandy loam and Gazos clay loam formed from acid material, and they lost fertility through the leaching process. Exchangeable sodium is generally accumulated in soils on alluvium that have poor drainage and a high or fluctuating water table. Under the influence of sodium, the clay particles tend to disperse in the soil and to pass downward with the percolating water. These particles form dense layers that are very slowly permeable. With alternate wetting and drying, coarse structure that is columnar, prismatic, or blocky forms in some of the affected soils. Willows clay has a moderate to large accumulation of exchangeable sodium. Accumulation is also moderate to large in some areas of Clear Lake clay, Pacheco silty clay, and Pacheco silt loam.

Translocation of silicate clay minerals has contributed to the formation of horizons mostly in soils of the terraces and some soils of the uplands. Many soils of the uplands, such as Los Gatos, and some soils on alluvium, such as Botella, show that there has been a little downward movement of silicate clay minerals to the layer immediately below the A horizon. This is indicated by a few clay films, generally in the larger pores, and a few darker coatings on the ped surfaces.

Antioch loam and Cotati loam, the soils with the most strongly developed horizons in the county, have a clay B horizon. This horizon has columnar or prismatic structure and abruptly underlies a 1- to 4-inch A2 horizon. Clay films are evident both in pores and on surfaces of peds. The abrupt change in texture from a loam A horizon to a clay B horizon indicates the amount of translocation of clay that has taken place.

Translocation of silicate clay minerals is important in the development of horizons in Auberry fine sandy loam, Botella loam, Cometa loam, Arguello loam, Los Banos clay loam, Pleasanton loam, Rincon loam, Rincon silty clay loam, and Vallecitos loam. This translocation is indicated by difference in texture in the A and B horizons. The B horizon is finer textured and contains clay films in pores and on surfaces of peds. Most of these soils are medium acid to neutral in the A and B horizons, but Rincon silty clay loam and Los Banos clay loam generally are mildly alkaline to moderately alkaline in the A horizon and calcareous in the B horizon. Rincon silty clay loam evidently was not completely leached of carbonates before the translocation of silicate clay minerals began, and the two processes are operating simultaneously. Los Banos clay loam may have formed under a more moist climate than Rincon silty clay loam and was probably recharged with carbonates after the climate became much drier.

Stratification of parent materials is important in horizon differentiation in many of the soils on alluvium, such as the Panoche, in some of the soils on terraces, such as the Pleasanton, and in a few of the soils on uplands, especially those formed in stratified soft sediments. In many soils stratification determines or affects the texture of various horizons, determines the amount, size, and composition of gravel in some horizons, and partly accounts for the variation of color in the soils of some soil series. The movement and content of water in some soils are affected by strata of rapidly permeable sand or of slowly permeable clay. Stratification also indicates changes in erosion and deposition and in drainage, steam channels, and flooding.

Restricted drainage in Pacheco silt loam and similar soils is partly caused by a slowly permeable layer at a depth of 4 to 10 feet. In some places Pleasanton loam shows stratification of parent material by variation in the amount, size, and composition of gravel in the horizons and by variation in texture in the lower part of the B and in the C horizons. Soils in alluvium generally have stratified parent material. This stratification is normally apparent in the subsoil and is partly responsible for differences in texture in the A horizon.

The reduction and transfer of iron, a process called gleying, has occurred to some extent in most of the soils in San Benito County that have impeded drainage. The effects of gleying are evident, but not prominent in the profiles of Willows clay, Pacheco silty clay, Pacheco silt loam, Clear Lake clay, Edenvale clay, and other somewhat poorly drained or poorly drained soils. Evidence of iron reduction and transfer can also be seen in small areas of soils with impeded drainage that are within larger areas of the well-drained soils.

The gray colors in the deeper horizons of somewhat poorly drained and poorly drained soils indicate the reduction of iron. This reduction is commonly accompanied by some transfer of iron. After reduction, iron may be removed completely from some horizons and may be removed from the soil. In San Benito County, however, the iron generally has moved only a short distance and has stopped either in the horizons of origin or in a horizon nearby. In some of the coarser textured soils, iron has been segregated within horizons and has formed strong-brown or yellowish-brown mottles and, in a few places, reddish-brown mottles.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationships to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First, through classification and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

Thus, in classification, soils are placed in narrow categories that are used in detailed soil surveys, so that knowledge about the soils can be organized and applied in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. They are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and later revised (*7*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. The current system is under continual study. Therefore, readers interested in developments of this system should search the latest literature available (*5*, *9*). The soil series of San Benito County are placed in some categories of the current system in table 7. The classes in the current system are briefly defined in the following paragraphs.

ORDER: Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil order are those that tend, generally, to give broad climatic groupings of soils. Two exceptions, Entisols and Histosols, occur in many different climates. The soil orders represented in San Benito County are Alfisols, Aridisols, Entisols, Inceptisols, Mollisols, Ultisols, and Vertisols.

SUBORDER: Each order is subdivided into suborders, primarily on the basis of those soil characteristics that seem to produce classes having the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders mainly reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

TABLE 7.—*Soil series classified according to the current system of classification*[1] *and the 1938 system with its later revisions*

Series	Current classification			1938 classification
	Family	Subgroup	Order	Great soil group
Antioch	Fine, montmorillonitic, thermic	Haplic Natrixeralfs	Alfisols	Soloth soils.
Arguello	Fine-loamy, mixed, thermic	Pachic Ultic Argixerolls	Mollisols	Brunizems.
Arnold	Sandy, mixed, thermic	Typic Xeropsamments	Entisols	Regosols.
Auberry	Fine-loamy, mixed, thermic	Ultic Haploxeralfs	Alfisols	Noncalcic Brown soils.
Botella	Fine-loamy, mixed, thermic	Pachic Argixerolls	Mollisols	Brunizems.
Cibo	Fine, montmorillonitic, thermic	Typical Chromoxererts	Vertisols	Grumusols.
Cieneba	Loamy, mixed, nonacid, thermic, shallow	Typic Xerorthents	Entisols	Lithosols.
Clear Lake	Fine, montmorillonitic, thermic	Typic Pelloxererts	Vertisols	Grumusols.
Climara	Fine, montmorillonitic, thermic	Chromic Pelloxererts	Vertisols	Grumusols.
Cometa	Fine, montmorillonitic, thermic	Typic Palexeralfs	Alfisols	Noncalcic Brown soils.
Conejo	Fine-loamy, mixed, thermic	Pachic Haploxerolls	Mollisols	Alluvial soils.
Corralitos	Sandy, mixed, thermic	Typic Xerpsamments	Entisols	Alluvial soils.
Cotati	Clayey, montmorillonitic, mesic	Typic Haploxerults	Ultisols	Planosols.
Cropley	Fine, montmorillonitic, thermic	Chromic Pelloxererts	Vertisols	Grumusols.
Diablo	Fine, montmorillonitic, thermic	Chromic Pelloxererts	Vertisols	Grumusols.
Docas	Fine-loamy, mixed, calcareous, thermic	Xeric Torrifluvents	Entisols	Alluvial soils.
Edenvale	Fine, montmorillonitic, thermic	Typic Pelloxererts	Vertisols	Grumusols.
Gaviota	Loamy, mixed, nonacid, thermic	Lithic Xerorthents	Entisols	Lithosols.
Gazos	Fine-loamy, mixed, thermic	Panhic Haploxerolls	Mollisols	Regosols intergrading to Brunizems.
Hanford	Coarse-loamy, mixed, nonacid, thermic	Typic Xerorthents	Entisols	Alluvial soils.
Henneke	Clayey-skeletal, serpentinitic, thermic	Lithic Argixerolls	Mollisols	Noncalcic Brown soils.
Kettleman	Fine-loamy, mixed, calcareous, thermic	Xeric Torriorthents	Entisols	Regosols.
Laniger	Ashy, thermic	Typic Vitrandepts	Inceptisols	Regosols.
Linne	Fine-loamy, mixed, thermic	Calcic Pachic Haploxerolls.	Mollisols	Regosols intergrading to Chestnut soils.
Lodo	Loamy, mixed, thermic	Lithic Haploxerolls	Mollisols	Lithosols.
Los Banos	Fine, montmorillonitic, thermic	Typic Haplargids	Aridisols	Noncalcic Brown soils.
Los Gatos	Fine-loamy, mixed, mesic	Typic Argixerolls	Mollisols	Brunizems.
Metz	Sandy, mixed, thermic	Typic Xerorthents	Entisols	Alluvial soils.
Mocho	Fine-loamy, mixed, thermic	Calcic Entic Haploxerolls.	Mollisols	Alluvial soils.
Montara	Loamy, serpentinitic, thermic	Lithic Haploxerolls	Mollisols	Lithosols.
Nacimiento	Fine-loamy, mixed, thermic	Calcic Entic Haploxerolls.	Mollisols	Regosols intergrading to Chestnut soils..
Pacheco	Fine-loamy, mixed, thermic	Aquic Haploxerolls	Mollisols	Humic Gley soils.
Panhill	Fine-silty, mixed, thermic	Typic Haplargids	Aridisols	Noncalcic Brown soils.
Panoche	Fine-loamy, mixed, calcareous, thermic	Xeric Torriorthents	Entisols	Alluvial soils.
Pinnacles	Fine, montmorillonitic, thermic	Ultic Palexeralfs	Alfisols	Noncalcic Brown soils.
Pinto	Fine-loamy, mixed, mesic	Argic Durixerolls	Mollisols	Noncalcic Brown soils intergrading to Yellowish-Brown Lateritic soils.
Pleasanton	Fine-loamy, mixed, thermic	Mollic Haploxeralfs	Alfisols	Noncalcic Brown soils.
Reiff	Coarse-loamy, mixed, nonacid, thermic	Typic Xerorthents	Entisols	Alluvial soils.
Rincon	Fine, montmorillonitic, thermic	Mollic Haploxeralfs	Alfisols	Noncalcic Brown soils intergrading to Brunizems.
Salinas	Fine-loamy, mixed, thermic	Calcic Pachic Haploxerolls.	Mollisols	Brunizems intergrading to Alluvial soils.
San Benito	Fine-loamy, mixed, thermic	Calcic Pachic Haploxerolls.	Mollisols	Regosols intergrading to Chestnut soils.
Santa Lucia	Clayey-skeletal, mixed, thermic	Pachic Ultic Haploxerolls.	Mollisols	Brunizems intergrading to Lithosols.
Shedd	Fine-loamy, mixed, calcareous, thermic	Xeric Torriorthents	Entisols	Regosols.
Sheridan	Coarse-loamy, mixed, mesic	Pachic Haploxerolls	Mollisols	Brunizems intergrading to Regosols.
Soper	Fine-loamy, mixed, thermic	Typic Argixerolls	Mollisols	Noncalcic Brown soils intergrading to Brunizems.
Sorrento	Fine-loamy, mixed, thermic	Calcic Entic Haploxerolls.	Mollisols	Alluvial soils.
Sween	Fine, montmorillonitic, thermic	Typic Argixerolls	Mollisols	Brunizems.
Vallecitos	Clayey, montmorillonitic, thermic	Ruptic-Lithic Mollic Palexeralfs.	Alfisols	Noncalcic Brown soils.
Willows	Fine, montmorillonitic, thermic	Chromic Pelloxererts	Vertisols	Solonchaks.
Yolo	Fine-silty, mixed, nonacid, thermic	Typic Xerocrepts	Inceptisols	Alluvial soils.

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[1] Placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Great Group: Soil suborders are separated into great groups on basis of uniformity in the kinds of major soil horizons in sequence of these horizons, and in characteristics these horizons possess. The horizons used to make separations into great groups are those in which clay, iron, or humus have accumulated or those that have pans interfering with growth of roots or movement of water. Among the characteristics considered are the self-mulching properties of clays, soil temperature, and major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium). The great group is not shown separately in table 7, because it is the last word in the name of the subgroup.

Subgroup: Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, that have properties of one great group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order.

Family: Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or behavior of soils used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

Series: As explained in the section "How This Survey Was Made," the series is a group of soils that have major horizons that, except for texture of the surface layer, are similar in important characteristics and arrangement in the profile. New soil series must be established and concepts of some established series, especially older ones that have been used little in recent years, must be revised in the course of the soil survey program across the country. A proposed new series has tentative status until review of the series concept at State, regional, and national levels of responsibility for soil classification results in a judgment that new series should be established. Most of the soil series described in this publication have been established earlier. Eight of the soil series used in this survey had tentative status when the survey was sent to the printer. They are the Cibo, Cieneba, Climara, Pacheco, Pinnacles, Reiff, San Benito, and Sween series.

General Nature of the County

This section discusses settlement and population, industries and transportation, water supply, agriculture, and climate of San Benito County. Statistics for population and agriculture are from reports by the U.S. Bureau of the Census.

Settlement and Population

The first settlement in the area that is now San Benito County was the San Juan Bautista Mission, which was founded by the Franciscan Fathers in 1797. The mission was the nucleus of the town of San Juan Bautista, and now it is one of the major tourist attractions in the county. The town of Hollister was laid out in 1868.

In February 1874, San Benito County was established by the California Legislature from part of Monterey County and Hollister was named the county seat. Later the county was enlarged to 893,440 acres when 43,440 acres were added from parts of Fresno and Merced Counties.

Rural settlement and growth of nonrural areas in San Benito County has closely paralleled agricultural development, though population has increased more slowly than in other areas of California. The population of San Benito County increased from 8,040 in 1910 to 15,396 in 1960. Hollister, which is the largest town had a population of 6,071 in 1960.

Industry and Transportation

The principal industries in San Benito County are those that process farm products. Petroleum and commercial sand and gravel are produced, and there is the mining of dolomite quicksilver, magnesite, limestone, and granite. Also, small manufacturing plants are located in the county.

The county is served by Federal, State, and local highways. State Route No. 25 (Airline Highway) crosses the county from north to south, and New Idria Road runs from Paicines to the southeastern part of the county. State Route No. 156 and U.S. Highway No. 101, the main coastal highway, cross the northern part of the county.

A branch of the Southern Pacific Lines extends to Hollister from a main line of that railroad in Santa Clara Valley nearby. This branch furnishes freight service. A municipal airport is located 2 miles north of Hollister.

Water Supply

In San Benito County both farming and industry depend on the quantity and quality of water. Quantity varies according to the amount of water in underground reservoirs that can be economically pumped, the annual drawdown of the underground water by pumping, the annual recharge of underground water, and the long-term effects of overdrafts on the underground water.

The use of irrigation for agricultural production started about 1890, and by 1960, 31,500 acres were irrigated from more than 700 wells. Water is pumped from depths ranging from 35 feet to more than 200 feet, but the average depth is about 100 feet. Drawdown is more than recharge, and reports indicate that the average annual overdraft is about 7,500 acre feet of water. Shortages of water may be serious if overuse of underground water continues.

The water generally is of good quality, but it contains an excessive amount of boron in several areas in the county. Some boron is necessary for plant growth but some crops are damaged if concentration reaches 1 part per million (p.p.m.). A concentration greater than 2 parts per million is generally considered hazardous to plants. Some evidence links the high content of boron to areas where geologic faulting is caused by deep intrusions of magma but the content of boron is also high in some deposits in old lakebeds.

Agriculture

Soon after settlement of San Benito County began, the grazing of livestock on the open range was the most important kind of agriculture. As settlement increased, however, the production of hay and small grains gradually replaced grazing on the deep, nearly level alluvial land in the Hollister and San Juan Valleys. Barley grown in these areas was noted for its brewing qualities. In about 1890, irrigation was introduced in these fertile valleys, and fruits and vegetables were intensively cultivated, as they are today. The surrounding hills and mountains are still used for grazing livestock.

Table 8 shows the acreage of the principal crops harvested in the county in 1964, and the numbers of grapevines and fruit and nut trees. The principal kinds and numbers of livestock grazed in the county in 1964 are shown in table 9.

TABLE 8.—*Acreage of crops in 1964*[1]

Crops	Acres
Barley	11, 493
Wheat	353
Oats	97
Corn	389
Alfalfa	3, 643
Sugar beets	3, 759
Tomatoes	3, 178
Lettuce	645
Green lima beans	298
Potatoes	296
Onions	271
Snap beans	200
Peppers	171
Seed beans	154
Squash	107
Fruit trees of all ages:	*Numbers*
Apple	23, 699
Peach	66
Pear	96, 222
Plum	259, 220
Prune	612
Cherry	4, 990
Apricot	372, 484
Grapevines	1, 509, 087
Nut trees of all ages:	
Walnut (English)	269, 517
Almond	373

[1] Small acreages of cucumbers, cabbage, spinach, cauliflower, and dry lima beans were also grown.

TABLE 9.—*Number of livestock on farms in 1964*

Livestock	Number
Cattle and calves	49, 876
Hogs and pigs	246
Sheep and lambs	14, 218
Chickens [1]	5, 937, 585

[1] 4 months old and older.

In 1964, approximately 87.2 percent of the 893,440 acres in San Benito County was in farms. The cropland totaled 119,961 acres, of which 44,355 acres was cropland pastured. Pasture totaled 693,288 acres and was made up of the cropland pastured, 16,387 acres of woodland pasture, and 632,546 acres of other pasture (noncropland, open range, or brush).

Climate

San Benito County has a moderate, relatively dry climate. Temperatures are occasionally high, particularly at the inland areas, but extremely low temperatures are rare. Precipitation is generally light, and irrigation is required for intensive cultivation of crops. Humidity is normally moderate to low, winds are light, and sunshine is abundant.

Effect of terrain on climate

San Benito County is characterized by mountains, peaks, passes, and valleys. These features affect climate by modifying the cool moist air that moves eastward from the Pacific Ocean and the hot, dry air that moves westward from the San Joaquin Valley in Fresno County.

The Gabilan Range, a spur of the Diablo Range, lies along the western border of the county and is a barrier to the cool moist air that moves in from the Pacific Ocean through the Salinas Valley in Monterey County. Some air from the Pacific, however, comes through the Chittenden Pass and spreads out through the rather broad Hollister Valley. The Diablo Range is in the eastern half of the county and has peaks that rise 4,000 and 5,000 feet above sea level and block out much of the hot air moving from the west. Near the extreme southeastern corner of the county, elevations fall as the east slopes of the range extend toward the San Joaquin Valley. West of the Diablo Range and within the Hollister Valley, summers are made cooler by the cool moist air from the Pacific Ocean, but the eastern part of the county near the San Joaquin Valley, particularly the southeastern corner, is hot and dry. The cool air moving into the Hollister Valley modifies afternoon temperatures that otherwise would be very high.

Precipitation is also affected by the rugged terrain. Winter storms bringing moisture from the Pacific Ocean cross the Santa Lucia Mountains and lose some moisture before crossing the Salinas Valley and entering the southern part of the county. The added lifting caused by a spur of the Diablo Range increases precipitation somewhat, but rainfall in the southern part of the county is less than it would be if the Santa Lucia Mountains had not already extracted some of the moisture. To the north, air moves from the Monterey Bay area through the Chittenden Pass and enters the Hollister area with a minimum of lifting and loss of moisture. As a result, the amount of moisture is somewhat greater in the northern part than the amount at equivalent elevations elsewhere in the county. Only in the southern part are the mountains so high that snow occurs with some regularity, but even here snowfall is light.

Temperature.—Table 10 gives temperature data for six weather bureau stations in San Benito County and adjacent Fresno County. The data in this table were compiled from records of different lengths and covering different periods of years.

The mean annual temperatures shown in table 10 reflect the influence of the mountainous terrain, of the marine air from the Pacific Ocean, and of the hot air from the San Joaquin Valley. The mean annual temperatures are lowest at the northwestern corner of the county near Chittenden Pass, where cool marine air holds temperatures down throughout most of the summer. Some of the mountain valleys are also cool during summer. The highest mean annual temperatures occur at low elevations in the southeastern part of the county near the San Joaquin Valley.

The mean minimum temperature in January averages below freezing in most of the mountain valleys and above freezing at lower elevations. Temperatures of 15° F. or lower have occurred at most places in the county, and a reading of 5° has been recorded at the Priest Valley Station. Such extreme temperatures, however, are infrequent and of short duration.

TABLE 10.—*Temperature data for six weather stations*

Month	Highest	Mean maximum	Mean temperature	Mean minimum	Lowest
HOLLISTER, SAN BENITO COUNTY					
January	84	60. 3	48. 8	37. 3	15
February	84	64. 1	52. 1	40. 1	22
March	89	68. 2	55. 1	42. 0	29
April	98	72. 2	58. 4	44. 5	31
May	101	75. 1	61. 6	48. 1	36
June	108	79. 2	65. 0	50. 7	38
July	109	82. 5	67. 6	52. 6	37
August	104	82. 2	67. 2	52. 2	41
September	109	83. 4	67. 5	51. 1	41
October	105	77. 7	62. 6	47. 5	28
November	92	69. 6	55. 4	41. 2	24
December	81	62. 2	50. 3	38. 4	21
Annual	109	73. 1	59. 3	45. 5	15
INDRIA, SAN BENITO COUNTY					
January	85	54. 5	45. 2	36. 1	14
February	82	56. 8	47. 3	37. 2	18
March	90	61. 8	51. 0	40. 1	18
April	94	68. 6	56. 7	44. 6	25
May	103	77. 0	63. 8	50. 5	30
June	111	85. 7	71. 8	57. 7	34
July	113	93. 2	80. 0	66. 7	40
August	112	93. 1	78. 4	64. 7	41
September	104	86. 1	72. 9	59. 0	39
October	96	75. 1	63. 2	51. 3	30
November	85	64. 5	53. 6	42. 6	21
December	86	57. 7	47. 8	38. 3	20
Annual	113	72. 8	61. 0	49. 1	14
MERCEY HOT SPRINGS, FRESNO COUNTY					
January	76	53. 7	44. 4	35. 2	16
February	76	57. 4	48. 9	38. 5	23
March	83	63. 1	52. 2	41. 2	27
April	92	70. 8	58. 4	46. 0	30
May	100	81. 3	66. 5	51. 7	32
June	108	88. 5	73. 5	58. 4	42
July	113	97. 2	81. 3	65. 5	46
August	113	95. 6	79. 8	64. 0	47
September	104	88. 7	73. 5	58. 2	42
October	99	78. 0	64. 1	50. 2	33
November	81	66. 6	53. 7	40. 6	20
December	76	57. 3	47. 3	36. 9	18
Annual	113	74. 9	61. 9	48. 9	16

TABLE 10.—*Temperature data for six weather stations*—Con.

Month	Highest	Mean maximum	Mean temperature	Mean minimum	Lowest
PANOCHE JUNCTION, FRESNO COUNTY					
January	72	54. 9	46. 0	37. 1	21
February	79	61. 1	50. 5	39. 8	24
March	85	66. 9	54. 7	42. 4	27
April	98	76. 3	62. 0	47. 6	32
May	107	85. 2	69. 0	52. 7	38
June	114	93. 4	76. 0	58. 6	41
July	114	100. 6	82. 2	63. 7	46
August	110	96. 8	79. 1	61. 4	46
September	113	91. 7	75. 8	59. 8	41
October	104	80. 0	70. 0	60. 0	35
November	86	66. 3	54. 9	43. 4	25
December	74	56. 7	47. 6	38. 4	22
Annual	114	77. 5	64. 0	50. 4	21
PINNACLES NATIONAL MONUMENT, SAN BENITO COUNTY					
January	83	59. 5	46. 5	33. 5	10
February	85	61. 8	48. 7	35. 6	18
March	88	65. 5	51. 3	37. 1	22
April	96	71. 5	55. 8	40. 0	24
May	104	79. 3	61. 7	44. 1	30
June	112	88. 2	67. 8	47. 4	32
July	113	96. 2	73. 6	51. 0	38
August	112	94. 6	72. 4	50. 1	38
September	114	91. 0	70. 1	49. 1	33
October	106	80. 6	62. 2	43. 7	26
November	93	70. 4	54. 0	37. 6	20
December	90	62. 4	48. 9	35. 3	20
Annual	114	76. 8	59. 4	42. 0	10
PRIEST VALLEY, SAN BENITO COUNTY					
January	74	54. 5	40. 7	26. 8	5
February	79	57. 5	42. 7	27. 8	11
March	81	60. 8	45. 4	30. 0	15
April	91	68. 5	51. 4	34. 3	18
May	102	75. 0	56. 3	37. 6	22
June	103	83. 4	63. 0	42. 5	29
July	110	92. 4	70. 7	49. 0	35
August	106	90. 4	68. 8	47. 2	34
September	106	86. 5	64. 9	43. 2	26
October	99	76. 3	56. 4	36. 4	15
November	85	64. 4	47. 5	30. 6	11
December	83	56. 7	43. 7	28. 6	14
Annual	110	72. 2	54. 2	36. 2	5

The mean maximum temperature in July ranges from about 75° in the Chittenden Pass area to about 100° east of Panoche. Temperatures above 100° are common in the eastern corner of the county, but they are infrequent in the western part. Maximum temperatures of at least 105° have been reported in areas most affected by marine air, and readings of 114° have been observed at other points within the county.

The length of the frost-free period, or growing season, varies throughout the county. It ranges from 275 days in the northwestern tip to 150 days at the southern tip. The growing season is about 275 days at Hollister, 250 days at Idria and Panoche, 200 days near Pinnacles National Monument, and 150 days in Priest Valley.

Precipitation.—Table 11 gives average monthly and annual precipitation for 15 weather bureau stations in San Benito County and in nearby Fresno County. The data in this table were compiled from records of different lengths and covering different periods of years. Because of the varied terrain, average annual precipitation varies considerably within short distances. Over most of the San Benito Valley, the annual rainfall is between 12 and 15 inches, but at higher elevations in the northern part of the county, rainfall is more than 20 inches. An annual total of 16 to 18 inches is common at the higher elevations in the central and southern parts of the county. In the southeastern part of the county near the San Joaquin Valley, annual rainfall is about 8 inches.

Total annual precipitation also varies considerably from year to year. In 5 years out of 10, between 5 and 10 inches can be expected in the southeastern part of the county and between 13 and 20 inches can be expected at the higher elevations in the northwestern and southern corners. In 1 year in 10, as much as 10 to 12 inches or as little as 4 inches can be expected in the southeastern part and as much as 25 to 30 inches or as little as 11 to 12 inches in the northwestern and southern corners.

The average intensity of rainfall in 1 year out of 2 amounts to 0.40 to 0.50 inch in 1 hour, 0.75 to 1.50 inches in 6 hours, and 1.00 to 3.00 inches in 24 hours. Only once in 100 years do these amounts increase to 0.90 to 1.00 inch in 1 hour, 1.90 to 3.75 inches in 6 hours, and 2.60 to 7.80 inches in 24 hours. The mountain areas receive the heaviest amounts.

Relative humidity.—During winter relative humidity is more than 50 percent most of the time. It averages 90 percent or more during the night in cooler areas and 75 percent or more in warmer areas. In spring relative humidity averages 60 to 75 percent at night and 40 to 50 percent during the day. Summers are quite dry, the average relative humidity in the daytime is about 20 to 25 percent in inland areas and 30 to 40 percent in areas that receive large amounts of marine air. In the areas receiving marine air, relative humidity increases to 70 percent or higher at night. In fall readings of 45 to 60 percent are common at night, but during the day readings generally range from 30 to 50 percent.

Wind.—Although records have not been kept, it appears that winds blow from the northwest during summer and from the southeast during winter. Winds in local areas may vary considerably from these typical conditions because of the terrain. Winds are normally light. Strong winds carrying marine air flow into the Hollister area at times during the summer. Strong winds blow over the entire county during winter storms.

Windspeeds may be expected to reach 30 miles per hour or slightly higher once every 2 years, 60 to 70 miles per hour once in 50 years, and 70 to 75 miles per hour once in 100 years.

TABLE 11.—*Average monthly and annual precipitation*

Station	January	February	March	April	May	June	July	August	September	October	November	December	Annual
	Inches	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*
Buena Vista	2. 45	2. 28	2. 19	1. 28	0. 49	0. 02	(1)	0. 01	0. 17	0. 55	1. 41	2. 55	13. 40
Chittenden Pass	3. 89	2. 90	2. 71	1. 57	. 59	. 06	. 01	. 01	. 46	. 62	1. 84	3. 63	18. 29
Hollister	2. 64	2. 20	2. 15	1. 01	. 44	. 10	. 02	. 01	. 50	. 57	1. 32	2. 33	13. 29
Idria	3. 09	3. 40	2. 60	1. 47	. 46	. 06	. 01	. 05	. 08	. 53	1. 07	3. 04	15. 86
Mercey Hot Springs	1. 90	1. 69	1. 16	. 79	. 24	. 02	. 02	. 01	. 17	. 31	. 48	1. 58	8. 37
Paicines Ohrwall Ranch	2. 75	2. 78	2. 24	1. 35	. 49	. 03	. 01	. 03	. 21	. 57	1. 58	3. 08	15. 12
Panoche	1. 97	1. 24	1. 10	. 82	. 31	. 03	(1)	. 01	. 10	. 36	. 92	1. 62	8. 48
Panoche Junction	1. 16	1. 05	. 99	. 68	. 29	. 04	(1)	(1)	. 09	. 23	. 45	. 98	5. 96
Pinnacles National Monument	3. 15	3. 25	2. 86	1. 37	. 37	. 03	(1)	(1)	. 14	. 47	1. 43	2. 95	16. 02
Priest Valley	3. 97	4. 39	3. 09	1. 75	. 50	. 09	. 01	. 02	. 16	. 55	1. 45	3. 89	19. 87
San Benito	2. 36	2. 56	2. 05	1. 24	. 33	. 06	(1)	. 01	. 10	. 54	1. 04	2. 73	13. 02
San Juan Bautista	3. 54	2. 79	2. 72	1. 49	. 59	. 08	(1)	. 03	. 29	. 58	2. 24	2. 88	17. 23
Stayton Mine	4. 30	3. 95	3. 49	2. 15	. 82	. 13	(1)	. 01	. 31	. 77	2. 57	4. 04	22. 54
Tres Pinos	4. 26	1. 69	2. 28	. 51	. 47	. 06	0	(1)	. 08	. 25	. 83	2. 21	12. 64
Upper Tres Pinos	2. 63	2. 52	2. 15	1. 14	. 29	. 05	. 01	. 01	. 09	. 44	1. 35	2. 95	13. 63

[1] Trace.

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Glossary

Accelerated erosion. Erosion of the soil or rock over and above normal erosion brought about by changes in the natural cover or ground conditions, including changes due to human activity and those caused by lightning or rodent invasion. (See also, Geologic Erosion.)

Alluvium. Fine material, such as gravel, sand, silt, or clay, deposited on land by streams.

Available water holding capacity (also termed available moisture holding capacity). The difference between the amount of water in a soil at field capacity and the amount in the same soil at the permanent wilting point of plants. Commonly expressed as inches of water per inch depth of soil.

Claypan. A compact, very slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent; will not hold together in a mass when dry or moist.

Friable.—When moist, crushes easily under gentle to moderate pressure between thumb and forefinger and can be pressed together in a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material; tends to stretch somewhat and pull apart rather than pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening. A weakly cemented mass is brittle and hard, but it can be broken in the hands. A strongly cemented mass is brittle; it is too hard to be broken in the hand but can easily be broken with a hammer. An indurated mass is very strongly cemented and brittle, does not soften under prolonged wetting, and a sharp blow with a hammer is required to break it.

Drainage, natural. Soil drainage that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural drainage are recognized. These classes range from excessively drained to very poorly drained.

Effective rooting depth. The depth from the surface, in inches, to which plant roots will penetrate. Depth classes: Very deep (60 inches or more), deep (40 to 60 inches), moderately deep (20 to 40 inches), shallow (10 to 20 inches), very shallow, (less than 10 inches).

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Forb. Any herbaceous plant, neither a grass nor a sedge, that is grazed on western ranges.

Geologic erosion. The wearing away of the land surface by wind, running water, and other geological agents.

Gleyed soil. A soil in which waterlogging and lack of oxygen have caused the material in one or more horizons to be neutral gray in color. The term "gleyed" is applied to soil horizons with yellow and gray mottling caused by intermittent waterlogging.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes.

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the mineral horizon in which living organisms are most active, and it is therefore marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused by (1) accumulation of clay, sesquioxides, humus, or some combination of these; (2) prismatic or blocky structure; and (3) redder or stronger colors than the A horizon; or (4) some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter, C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Montmorillonite. A fine, platy, alumino-silicate clay mineral that expands and contracts with the absorption and loss of water. It has a high cation-exchange capacity and is plastic and sticky when moist.

Morphology, soil. The makeup of the soil, including the texture, structure, consistence, color, and other physical, chemical, mineralogical, and biological properties of the various horizons that make up the soil profile.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6 , and a chroma of 4.

Organic matter. For the purposes of this survey, organic matter content is classified as follows: Low, 0 to 1½ percent; medium, 1½ to 2½ percent; high, over 2½ percent.

Permeability, soil. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: Very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid.

Profile soil. A vertical section of the soil through all its horizons and extending into the parent material. See Horizon, soil.

Reaction, soil. The degree of acidity or alkalinity of a soil expressed in words and in pH values, as follows:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Saline-alkali soil. A soil that contains a harmful quantity of salts and either a high degree of alkalinity, a large amount of exchangeable sodium, or both, so distributed in the soil profile that the growth of most crop plants is less than normal.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the base of a slip surface on a relatively steep slope; and in swelling clays, where there is marked change in moisture content.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of the soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plants and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly the part of the profile below plow depth and above the substratum.

Surface soil or layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (geological). A level or gently undulating old alluvial plain bordering a stream valley, river, lake or the sea. Elevation is intermediate between that of the flood plain and the upland.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportions of fine particles are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The textural classes may be further described as "coarse," "fine," or "very fine" and by "gravely," "stony," or "rocky."

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs.

Dashes indicate that the soil was not placed in a pasture and range site. Other information is given in tables as follows:

Acreage and extent, table 1, p. 7. Estimated yields, table 2, p. 69. Storie index rating, table 3, p. 73.	Engineering uses of the soils, tables 4, 5, and 6, pp. 80 through 99.

Map symbol	Mapping unit	Described on page	Capability unit		Pasture and range site	
			Symbol	Page	Number	Page
AnA	Antioch loam, 0 to 2 percent slopes	9	IIIs-3(14)	63	4	77
AnB	Antioch loam, 2 to 5 percent slopes	9	IIIe-3(14) IVe-3(15)	60 64	4	77
AnC2	Antioch loam, 5 to 9 percent slopes, eroded	9	IIIe-3(14) IVe-3(15)	60 64	4	77
AoD2	Antioch clay loam, 9 to 15 percent slopes, eroded	9	IVe-3(15)	64	4	77
ArC	Arguello loam, 2 to 9 percent slopes	10	IIIe-1(15)	60	--	--
AsD	Arguello shaly loam, 9 to 15 percent slopes	10	IVe-1(15)	64	2	76
AtD	Arnold loamy sand, 9 to 15 percent slopes	11	IIIs-4(14)	63	3	76
AtE2	Arnold loamy sand, 15 to 30 percent slopes, eroded	11	VIe-4(15)	66	3	76
AtF3	Arnold loamy sand, 30 to 50 percent slopes, severely eroded	10	VIIe-4(15)	67	3	76
AuE	Auberry fine sandy loam, 15 to 30 percent slopes	11	VIe-1(15)	66	3	76
AuG2	Auberry fine sandy loam, 30 to 75 percent slopes, eroded	11	VIIe-1(15)	67	3	76
BaG	Badland	12	VIIIe-1(15)	68	--	--
BoA	Botella loam, 0 to 2 percent slopes	12	I-1(14) IIIc-1(15)	56 64	--	--
BoC	Botella loam, 2 to 9 percent slopes	12	IIe-1(14) IIIe-1(15)	57 60	--	--
CbF2	Cibo stony clay, 15 to 50 percent slopes, eroded	13	VIs-5(15)	66	5	78
CcG2	Cibo rocky clay, shallow, 15 to 75 percent slopes, eroded	13	VIIs-1(15)	68	5	78
CgG3	Cieneba gravelly sandy loam, 15 to 75 percent slopes, severely eroded	13	VIIIs-1(15)	68	--	--
CgG2	Cieneba gravelly sandy loam, 30 to 75 percent slopes, eroded	14	VIIe-4(15)	67	3	76
Ch	Clear Lake clay	14	IIs-5(14)	59	--	--
Ck	Clear Lake clay, saline	14	IIIw-5(14)	62	11	79
Cl	Clear Lake silty clay loam	14	IIIw-5(15)	62	--	--
CmD	Climara clay, 9 to 15 percent slopes	14	IIIe-5(15)	62	1	76
CmF2	Climara clay, 15 to 50 percent slopes, eroded	15	VIe-5(15)	66	1	76
CnD2	Cometa loam, 5 to 15 percent slopes, eroded	15	IVe-3(15)	64	4	77
CoD2	Cometa sandy loam, 5 to 15 percent slopes, eroded	15	IVe-3(15)	64	4	77
CpC	Conejo clay loam, 2 to 9 percent slopes	16	IIIe-5(15)	62	--	--
CuC	Corralitos loamy sand, 2 to 9 percent slopes	16	IIIs-4(14)	63	--	--
CvC	Cotati loam, 2 to 9 percent slopes	17	IVe-3(15)	64	4	77
CvD2	Cotati loam, 9 to 15 percent slopes, eroded	17	VIe-3(15)	66	4	77
CvE2	Cotati loam, 15 to 30 percent slopes, eroded	17	VIe-3(15)	66	4	77
CwA	Cropley clay, 0 to 2 percent slopes	18	IIs-5(14)	59	--	--
CwC	Cropley clay, 2 to 9 percent slopes	18	IIe-5(14) IIIe-5(15)	58 62	--	--
CyC	Cropley silty clay loam, 2 to 9 percent slopes	19	IIe-5(14)	58	--	--
DaD	Diablo clay, 9 to 15 percent slopes	20	IIIe-5(15)	62	1	76
DaE2	Diablo clay, 15 to 30 percent slopes, eroded	19	IVe-5(15)	65	1	76
DaF2	Diablo clay, 30 to 50 percent slopes, eroded	20	VIe-5(15)	66	1	76
DaG3	Diablo clay, 50 to 75 percent slopes, severely eroded	20	VIIe-5(15)	67	1	76
DlD	Diablo-Linne complex, 9 to 15 percent slopes	20	IIIe-5(15)	62	1	76
DlE2	Diablo-Linne complex, 15 to 30 percent slopes, eroded	20	IVe-5(15)	65	1	76

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit		Pasture and range site	
			Symbol	Page	Number	Page
DlF2	Diablo-Linne complex, 30 to 50 percent slopes, eroded	20	VIe-5(15)	66	1	76
DoA	Docas silt loam, 0 to 2 percent slopes	20	IVc-1(15)	65	7	78
DoC	Docas silt loam, 2 to 9 percent slopes	21	IVc-1(15)	65	7	78
DsA	Docas clay loam, 0 to 2 percent slopes	21	IVc-1(15)	65	7	78
DsC	Docas clay loam, 2 to 9 percent slopes	21	IVc-1(15)	65	7	78
EcA	Edenvale clay, 0 to 2 percent slopes	21	IIIw-5(15)	62	--	--
GaE	Gaviota loam, 15 to 30 percent slopes	23	VIe-1(15)	66	6	78
GaE2	Gaviota loam, 15 to 30 percent slopes, eroded	23	VIe-1(15)	66	6	78
GaF2	Gaviota loam, 30 to 50 percent slopes, eroded	22	VIIe-1(15)	67	6	78
GrF2	Gaviota rocky loam, 15 to 50 percent slopes, eroded	23	VIIs-1(15)	68	6	78
GsD	Gazos silty clay loam, 9 to 15 percent slopes	24	IIIe-5(15)	62	5	78
GtE2	Gazos clay loam, 15 to 30 percent slopes, eroded	23	IVe-5(15)	65	5	78
GtF2	Gazos clay loam, 30 to 50 percent slopes, eroded	24	VIe-5 (15)	66	5	78
GtG3	Gazos clay loam, 50 to 75 percent slopes, severely eroded	24	VIIe-5(15)	67	5	78
GuE	Gullied land	24	VIIe-1(15)	67	6	78
HaA	Hanford coarse sandy loam, 0 to 2 percent slopes	24	IIs-4(14) IIIs-4(15)	59 63	--	--
HaC	Hanford coarse sandy loam, 2 to 9 percent slopes	25	IIIe-4(14) IIIe-1(15)	61 60	--	--
HfA	Hanford loam, 0 to 2 percent slopes	25	I-1(14) IIIc-1(15)	56 64	--	--
HfC	Hanford loam, 2 to 9 percent slopes	25	IIe-1(14) IIIe-1(15)	57 60	--	--
HnF2	Henneke fine gravelly loam, 15 to 50 percent slopes, eroded	25	VIIe-1(15)	67	8	78
HsG3	Henneke soils, 15 to 75 percent slopes, severely eroded	26	VIIIs-1(15)	68	--	--
IgC	Igneous rock land	26	VIIIs-1(15)	68	--	--
KeD	Kettleman loam, 5 to 15 percent slopes	27	VIe-1(15)	66	9	79
KeF2	Kettleman loam, 15 to 50 percent slopes, eroded	26	VIIe-1(15)	67	9	79
KmF2	Kettleman soils, 15 to 50 percent slopes, eroded	27	VIIe-1(15)	67	9	79
LaG3	Laniger gravelly sandy loam, 30 to 75 percent slopes, severely eroded	27	VIIe-4(15)	67	3	76
LdF	Landslides	27	VIIe-5(15)	67	1	76
LnD	Linne clay loam, 9 to 15 percent slopes	28	IIIe-5(15)	62	1	76
LnE2	Linne clay loam, 15 to 30 percent slopes, eroded	28	IVe-5(15)	65	1	76
LnF2	Linne clay loam, 30 to 50 percent slopes, eroded	28	VIe-5(15)	66	1	76
LnF3	Linne clay loam, 30 to 50 percent slopes, severely eroded	28	VIIe-5(15)	67	1	76
LsE2	Linne-Shedd complex, 15 to 30 percent slopes, eroded	28	IVe-5(15)	65	7	78
LsF2	Linne-Shedd complex, 30 to 50 percent slopes, eroded	29	VIe-5(15)	66	7	78
LtG2	Lodo shaly loam, 50 to 75 percent slopes, eroded	29	VIIe-1(15)	67	5	78
LuC	Los Banos clay loam, 2 to 9 percent slopes	30	VIIe-1(15)	67	10	79
LuD2	Los Banos clay loam, 9 to 15 percent slopes, eroded	29	VIIe-1(15)	67	10	79
LuF3	Los Banos clay loam, 15 to 50 percent slopes, severely eroded	30	VIIe-1(15)	67	9	79
LvE	Los Gatos clay loam, 15 to 30 percent slopes	30	IVe-5(15)	65	5	78
LvF2	Los Gatos clay loam, 30 to 50 percent slopes, eroded	30	VIe-5(15)	66	5	78
LwF2	Los Gatos rocky clay loam, 15 to 50 percent slopes, eroded	31	VIs-5(15)	66	5	78
MeA	Metz sandy loam, 0 to 2 percent slopes	31	IIs-4(14) IIIs-4(15)	59 63	--	--
MgA	Metz gravelly sandy loam, 0 to 2 percent slopes	31	IIIs-4(14)	63	--	--
MgC	Metz gravelly sandy loam, 2 to 9 percent slopes	31	IIIe-4(14)	61	--	--
MhA	Metz sandy loam, wet variant, 0 to 2 percent slopes	32	IIw-2(14)	59	--	--
MnG	Mine pits and dumps	32	VIIIs-1(15)	68	--	--
MoA	Mocho sandy loam, 0 to 2 percent slopes	33	I-1(14) IIIc-1(15)	56 64	--	--
MoC	Mocho sandy loam, 2 to 9 percent slopes	33	IIe-1(14) IIIe-1(15)	57 60	--	--

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit		Pasture and range site	
			Symbol	Page	Number	Page
MpA	Mocho loam, 0 to 2 percent slopes	32	I-1(14) IIIc-1(15)	56 64	--	--
MpC	Mocho loam, 2 to 9 percent slopes	33	IIe-1(14) IIIe-1(15)	57 60	--	--
MrB	Mocho gravelly loam, 2 to 5 percent slopes	33	IIe-1(14)	57	--	--
MsC	Mocho clay loam, 2 to 9 percent slopes	33	IIe-5(14) IIIe-5(15)	58 62	--	--
MtF2	Montara rocky silty clay loam, 15 to 50 percent slopes, eroded	33	VIIs-9(15)	68	8	78
NaD	Nacimiento clay loam, 9 to 15 percent slopes	34	IIIe-5(15)	62	1	76
NaE	Nacimiento clay loam, 15 to 30 percent slopes	34	IVe-5(15)	65	1	76
NaF2	Nacimiento clay loam, 30 to 50 percent slopes, eroded	34	VIe-5(15)	66	1	76
NaG2	Nacimiento clay loam, 50 to 75 percent slopes, eroded	34	VIIe-5(15)	67	1	76
NcG3	Nacimiento loam, 30 to 75 percent slopes, severely eroded	34	VIIIe-1(15)	68	--	--
Pa	Pacheco silt loam	35	IIw-2(14)	59	11	79
Pc	Pacheco loam	35	IIw-2(14)	59	--	--
Pd	Pacheco clay loam over clay	35	IIw-2(14)	59	--	--
Pe	Pacheco silty clay	35	IIs-5(14)	59	--	--
PhC	Panhill loam, 2 to 9 percent slopes	36	VIIc-1(15)	68	10	79
PkA	Panoche sandy loam, 0 to 2 percent slopes	37	I-1(17) VIIc-1(15)	57 68	10	79
PkC	Panoche sandy loam, 2 to 9 percent slopes	38	IIe-1(17) VIIc-1(15)	58 68	10	79
PlA	Panoche loam, 0 to 2 percent slopes	37	I-1(17) VIIc-1(15)	57 68	10	79
PlC	Panoche loam, 2 to 9 percent slopes	37	IIe-1(17) VIIc-1(15)	58 68	10	79
PnE2	Pinnacles coarse sandy loam, 15 to 30 percent slopes, eroded	38	VIe-3(15)	66	3	76
PnG3	Pinnacles coarse sandy loam, 30 to 75 percent slopes, severely eroded	38	VIIe-1(15)	67	3	76
PsE2	Pinto sandy loam, 15 to 30 percent slopes, eroded	39	VIe-1(15)	66	3	76
PtB	Pleasanton loam, 2 to 5 percent slopes	39	IIe-1(14) IIIe-3(15)	57 61	4	77
PvC2	Pleasanton gravelly loam, 5 to 9 percent slopes, eroded	39	IIIe-1(14) IIIe-3(15)	60 61	4	77
ReA	Reiff sandy loam, 0 to 2 percent slopes	40	I-1(14) IIIc-1(15)	56 64	--	--
ReC	Reiff sandy loam, 2 to 9 percent slopes	40	IIe-1(14) IIIe-1(15)	57 60	--	--
RnA	Rincon loam, 0 to 2 percent slopes	41	IIs-5(14)	59	--	--
RnC	Rincon loam, 2 to 9 percent slopes	41	IIIe-1(14) IIIe-3(14)	60	--	--
RnD2	Rincon loam, 9 to 15 percent slopes, eroded	41	IVe-1(15)	64	4	77
RsA	Rincon silty clay loam, 0 to 2 percent slopes	40	IIs-5(14) IIe-5(14)	59 58	--	--
RsC	Rincon silty clay loam, 2 to 9 percent slopes	41	IIIe-5(15)	62	--	--
RsD2	Rincon silty clay loam, 9 to 15 percent slopes, eroded	41	IIIe-5(15)	62	4	77
Rw	Riverwash	41	VIIIw-4(14)	68	--	--
SaA	Salinas clay loam, 0 to 2 percent slopes	42	I-1(14) IIIc-1(15)	56 64	--	--
SaC	Salinas clay loam, 2 to 9 percent slopes	42	IIe-5(14) IIIe-5(15)	58 62	--	--
SbD	San Benito clay loam, 9 to 15 percent slopes	43	IIIe-5(15)	62	5	78
SbE2	San Benito clay loam, 15 to 30 percent slopes, eroded	42	IVe-5(15)	65	5	78

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit		Pasture and range site	
			Symbol	Page	Number	Page
SbF2	San Benito clay loam, 30 to 50 percent slopes, eroded	43	VIe-5(15)	66	5	78
SbF3	San Benito clay loam, 30 to 50 percent slopes, severely eroded	43	VIIe-5(15)	67	5	78
Sc	Sandy alluvial land	44	VIIw-4(14)	67	5	78
SdF2	Santa Lucia shaly loam, 30 to 50 percent slopes, eroded	44	VIe-1(15)	66	2	76
SdG3	Santa Lucia shaly loam, 30 to 75 percent slopes, severely eroded	44	VIIe-1(15)	67	2	76
SeG	Sedimentary rock land	44	VIIIs-1(15)	68	--	--
ShD	Shedd loam, 9 to 15 percent slopes	45	IVe-1(15)	64	7	78
ShE2	Shedd loam, 15 to 30 percent slopes, eroded	45	VIe-1(15)	66	7	78
ShF2	Shedd loam, 30 to 50 percent slopes, eroded	45	VIIe-1(15)	67	7	78
ShF3	Shedd loam, 30 to 50 percent slopes, severely eroded	45	VIIe-1(15)	67	7	78
SkD	Sheridan coarse sandy loam, 9 to 15 percent slopes	46	IVe-1(15)	64	3	76
SkE	Sheridan coarse sandy loam, 15 to 30 percent slopes	46	VIe-4(15)	66	3	76
SkE2	Sheridan coarse sandy loam, 15 to 30 percent slopes, eroded	46	VIe-4(15)	66	3	76
SkG2	Sheridan coarse sandy loam, 30 to 75 percent slopes, eroded	46	VIIe-4(15)	67	3	76
SkG3	Sheridan coarse sandy loam, 30 to 75 percent slopes, severely eroded	46	VIIe-4(15)	67	3	76
SlD	Soper gravelly loam, 9 to 15 percent slopes	47	IVe-1(15)	64	3	76
SlE2	Soper gravelly loam, 15 to 30 percent slopes, eroded	47	VIe-1(15)	66	3	76
SlF2	Soper gravelly loam, 30 to 50 percent slopes, eroded	47	VIIe-1(15)	67	3	76
SmD	Soper sandy loam, 9 to 15 percent slopes	47	IVe-1(15)	64	3	76
SmE2	Soper sandy loam, 15 to 30 percent slopes, eroded	47	VIe-1(15)	66	3	76
SmF2	Soper sandy loam, 30 to 50 percent slopes, eroded	47	VIIe-1(15)	67	3	76
SnA	Sorrento silt loam, 0 to 2 percent slopes	48	I-1(14) IIIc-1(15)	56 64	--	--
SnC	Sorrento silt loam, 2 to 9 percent slopes	48	IIe-1(14) IIIe-1(15)	57 60	--	--
SoB	Sorrento gravelly loam, 0 to 5 percent slopes	48	IIs-4(14)	59	--	--
SrA	Sorrento silty clay loam, 0 to 2 percent slopes	48	I-1(14) IIIc-1(15)	56 64	--	--
SrC	Sorrento silty clay loam, 2 to 9 percent slopes	48	IIe-5(14) IIIe-5(15)	58 62	--	--
SsE2	Sween rocky clay loam, 15 to 30 percent slopes, eroded	50	VIs-5(15)	66	5	78
SsF2	Sween rocky clay loam, 30 to 50 percent slopes, eroded	50	VIs-5(15)	66	5	78
StE2	Sween stony clay loam, 15 to 30 percent slopes, eroded	50	VIs-5(15)	66	5	78
SwF2	Sween very stony clay loam, 15 to 50 percent slopes, eroded	50	VIIs-1(15)	68	5	78
TeF	Terraces escarpments	51	VIe-1(15)	66	4	77
VaD	Vallecitos loam, 9 to 15 percent slopes	51	IVe-1(15)	64	6	78
VaE	Vallecitos loam, 15 to 30 percent slopes	51	VIe-1(15)	66	6	78
VaF	Vallecitos loam, 30 to 50 percent slopes	51	VIe-1(15)	66	6	78
VaF2	Vallecitos loam, 30 to 50 percent slopes, eroded	51	VIIe-1(15)	67	6	78
VrE2	Vallecitos rocky loam, 9 to 30 percent slopes, eroded	52	VIs-5(15)	66	6	78
VrF2	Vallecitos rocky loam, 30 to 50 percent slopes, eroded	52	VIIs-1(15)	68	6	78
Wc	Willows clay	52	IIIw-5(14) IIIw-5(15)	62 62	--	--
Wk	Willows clay, saline-alkali	52	IVw-6(14)	65	11	79
Ws	Willows sandy loam	52	IIIw-5(14)	62	--	--
Ww2	Willows soils, eroded	53	IVw-6(14)	65	11	79
YoA	Yolo loam, 0 to 2 percent slopes	53	IIIc-1(15)	64	--	--
YoC	Yolo loam, 2 to 9 percent slopes	53	IIIe-1(15)	60	--	--
YvB	Yolo gravelly loam, 0 to 5 percent slopes	53	IIIe-1(15)	60	--	--

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Appendix C. USACE Arid West Wetland Determination Data Forms

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: South County Right of Way City/County: San Benito Sampling Date: 3/11/14 and 5/1/14
Applicant/Owner: Santa Clara Valley Water District State: CA Sampling Point: 2a
Investigator(s): M. Goklany & C. Gurney Section/Township/Range: T10S,R6E,sec24
Landform (hillslope, terrace, etc.): floodplain Local Relief (concave, convex, none): concave Slope (%): 2
Subregion (LRR): C Lat: 37.04305 Long: -121.27319 Datum: WGS 84
Soil Map Unit Name: VaG2 NWI classification R3UBH
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No x (If no, explain in Remarks.)
Are Vegetation ____ Soil ____ or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes x No ____
Are Vegetation ____ Soil x or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes x	No	**Is the Sampled Area within a Wetland?**	Yes x No
Hydric Soil Present?	Yes	No x		
Wetland Hydrology Present?	Yes x	No		

Remarks:

Pacheco Conduit #2. Clear, dry weather conditions on 3/11/14. The site was revisited on 5/1/14 to identify plants that did not initially have vegetative/reproductive structures. Seasonal wetland is in active floodplain of Pacheco Creek (in a concave depression). Soil is likely recently deposited and has not had time to develop redox features.

Drought has resulted in drier than normal conditions. The area has received 23% of normal annual rainfall during the current growing season. Approximately 2.45" of precipitation fell during the week prior to wetland delineation survey.

VEGETATION

Tree Stratum (Plot size: 30' radius)	Absolute Cover %	Dominant Species?	Indicator Status
1. *Platanus racemosa*	10	Y	FAC
2.			
3.			
4.			
Total Cover:	10		
Sapling/Shrub Stratum (Plot size: 30' radius)			
1. *Baccharis salicifolia*	10	Y	FAC
2.			
3.			
4.			
5.			
Total Cover:	10		
Herb Stratum (Plot size: 5' x 5')			
1. *Bromus hordeaceus*	5	N	FACU
2. *Artemisia douglasiana*	3	N	FAC
3. *Eleocharis macrostachya* (*E. palustris*)	5	N	OBL
4. *Polypogon monspeliensis*	10	N	FACW
5. *Juncus xiphioides*	T	N	OBL
6. *Phyla nodiflora*	7	N	FACW
7. *Lotus corniculatus*	45	Y	FAC
8. *Juncus bufonius*	7	N	FACW
Total Cover:	82		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL Species		x 5 =
Column totals	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

____ Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes x No ____

Remarks:

Herbs: 0.5 x 82 = 41, 0.2 x 20 = 16.4, FAC-neutral test 0:0

SOIL

Sampling Point: 2a

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2	100					loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) **(LRR C)**
___ 1 cm Muck (A9) (**LRR D**)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)

___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If present):

Type: cobble
Depth (inches): 6

Hydric Soil Present? Yes ___ No x

Remarks:
Soil is saturated. Cobble layer prohibited sampling at a depth greater than 6". No hydric indicators observed. The sampling location is in the active floodplain of a riverine system and deposition/erosion is common during storm events.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required: check all that apply)

x Surface Water (A1)
___ High Water Table (A2)
x Saturation (A3)
___ Water Marks (B1) (**Nonriverine**)
___ Sediment Deposits (B2) (**Nonriverine**)
___ Drift Deposits (B3) (**Nonriverine**)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-stained Leaves (B9)

___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Plowed Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) (**Riverine**)
___ Sediment Deposits (B2) (**Riverine**)
___ Drift Deposits (B3) (Riverine)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes x No ___ Depth (inches): 2
Water Table Present? Yes ___ No x Depth (inches): ___
Saturation Present? Yes x No ___ Depth (inches): 6
(includes capillary fringe)

Wetland Hydrology Present? Yes x No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Surface water covers 10% of the wetland.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: South County Right of Way City/County: San Benito Sampling Date: 3/11/14 and 5/1/14
Applicant/Owner: Santa Clara Valley Water District State: CA Sampling Point: 2b
Investigator(s): M. Goklany & C. Gurney Section/Township/Range: T10S,R6E,sec24
Landform (hillslope, terrace, etc.): toe of slope / floodplain Local Relief (concave, convex, none): convex Slope (%): 2-5
Subregion (LRR): C Lat: 37.04305 Long: -121.27325 Datum: WGS 84
Soil Map Unit Name: VaG2 NWI classification R3UBH
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No x (If no, explain in Remarks.)
Are Vegetation ____ Soil ____ or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes x No ____
Are Vegetation ____ Soil ____ or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No x	**Is the Sampled Area within a Wetland?**	Yes ____ No x
Hydric Soil Present?	Yes ____	No x		
Wetland Hydrology Present?	Yes ____	No x		

Remarks:

Pacheco Conduit #2. Clear, dry weather conditions on 3/11/14. The site was revisited on 5/1/14 to identify plants that did not initially have vegetative/reproductive structures. Sampling location is in active floodplain of Pacheco Creek (in a concave depression). Habitat is sycamore alluvial woodland.

Drought has resulted in drier than normal conditions. The area has received 23% of normal annual rainfall during the current growing season. Approximately 2.45" of precipitation fell during the week prior to wetland delineation survey.

VEGETATION

	Absolute Cover %	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30' radius)			
1. *Platanus racemosa*	10	Y	FAC
2.			
3.			
4.			
Total Cover:	10		
Sapling/Shrub Stratum (Plot size: 30' radius)			
1. *Baccharis pilularis*	10	Y	UPL
2.			
3.			
4.			
5.			
Total Cover:	10		
Herb Stratum (Plot size: 5' x 5')			
1. *Bromus hordeaceus*	15	N	FACU
2. *Bromus diandrus*	25	Y	UPL
3. *Bromus madritensis*	15	N	UPL
4. *Grindelia camporum*	3	N	FACU
5. *Artemisia douglasiana*	5	N	FAC
6. *Centaurea solstitialis*	40	Y	UPL
7. *Erodium cicutarium*	3	N	UPL
8.			
Total Cover:	106		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	25	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	15	x 3 = 45
FACU species	18	x 4 = 72
UPL Species	93	x 5 = 465
Column totals	126 (A)	582 (B)

Prevalence Index = B/A = 4.6

Hydrophytic Vegetation Indicators:

____ Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ____ No x

Remarks:

Herbs: 0.5 x 106= 53, 0.2 x 20 = 16.4, FAC-neutral test 0:0

SOIL

Sampling Point: 2b

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2	100					loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) **(LRR C)**
___ 1 cm Muck (A9) (**LRR D**)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If present):
Type: cobble
Depth (inches): 6

Hydric Soil Present? Yes ___ No x

Remarks:
Soil is saturated. Cobble layer prohibited sampling at a depth greater than 6”. No hydric indicators observed. The sampling location is in the active floodplain of a riverine system and deposition/erosion is common during storm events.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required: check all that apply)

x Surface Water (A1)
___ High Water Table (A2)
x Saturation (A3)
___ Water Marks (B1) (**Nonriverine**)
___ Sediment Deposits (B2) (**Nonriverine**)
___ Drift Deposits (B3) (**Nonriverine**)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Plowed Soils (C6)
___ Thin Muck Surface (C7)
Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) (**Riverine**)
___ Sediment Deposits (B2) (**Riverine**)
___ Drift Deposits (B3) (Riverine)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes x	No ___	Depth (inches): ___
Water Table Present?	Yes ___	No x	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): ___

Wetland Hydrology Present? Yes x No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Surface water is 2” deep and covers 10% of the seasonal wetland.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: South County Right of Way City/County: Santa Clara Sampling Date: 3/6/14 and 4/29/14
Applicant/Owner: Santa Clara Valley Water District State: CA Sampling Point: 11a
Investigator(s): M. Goklany & C. Gurney Section/Township/Range: T11S,R5E,sec16
Landform (hillslope, terrace, etc.): valley Local Relief (concave, convex, none): slightly concave Slope (%): 0-2
Subregion (LRR): C Lat: 36.96869 Long: -121.43165 Datum: WGS 84
Soil Map Unit Name: Pa NWI classification none
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No x (If no, explain in Remarks.)
Are Vegetation ____ Soil x or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes x No ____
Are Vegetation ____ Soil ____ or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No x	**Is the Sampled Area within a Wetland?**	Yes ____ No x
Hydric Soil Present?	Yes ____	No x		
Wetland Hydrology Present?	Yes ____	No x		

Remarks:

Santa Clara Conduit #11. Clear, dry weather conditions on 3/6/14. The site was revisited on 4/29/14 to identify plants that did not initially have vegetative/reproductive structures. Fill soil has likely been placed in various locations around the vault to the pipeline.

Drought has resulted in drier than normal conditions. The area has received 23% of normal annual rainfall during the current growing season. Approximately 2.45" of precipitation fell during the week prior to wetland delineation survey.

VEGETATION

Tree Stratum (Plot size: 30' radius)	Absolute Cover %	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	0		
Sapling/Shrub Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
Total Cover:	0		
Herb Stratum (Plot size: 5' x 5')			
1. *Chenopodium album*	25	Y	FACU
2. *Malva nicaeensis*	5	N	UPL
3. *Bromus diandrus*	10	Y	UPL
4. *Hordeum murinum*	7	N	FACU
5. *Melilotus indicus*	15	Y	FACU
6. *Dittrichia graveolens*	2	N	UPL
7.			
8.			
Total Cover:	64		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 36 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	3	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species	47	x 4 = 188
UPL Species	17	x 5 = 85
Column totals	64 (A)	273 (B)

Prevalence Index = B/A = 4.3

Hydrophytic Vegetation Indicators:

____ Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ____ No x

Remarks:

0.5 x 64 = 32, 0.2 x 64 = 12.8, FAC-neutral test: 0:0

SOIL

Sampling Point: 11a

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-13	10YR 3/1	40	7.5YR 5/8	1	C	M	loam	
	10YR 3/2	60						

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains

[2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No x

Remarks:

No hydric indicators.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required: check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (Riverine)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- x FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No x Depth (inches): ___

Water Table Present? Yes ___ No x Depth (inches): ___

Saturation Present? Yes ___ No x Depth (inches): ___
(includes capillary fringe)

Wetland Hydrology Present? Yes ___ No x

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No hydrology indicators.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: South County Right of Way City/County: Santa Clara Sampling Date: 3/6/14 and 4/29/14

Applicant/Owner: Santa Clara Valley Water District State: CA Sampling Point: 11b

Investigator(s): M. Goklany & C. Gurney Section/Township/Range: T11S,R5E,sec16

Landform (hillslope, terrace, etc.): valley / shallow depression Local Relief (concave, convex, none): concave Slope (%): 0-2

Subregion (LRR): C Lat: 36.96876 Long: -121.43240 Datum: WGS 84

Soil Map Unit Name: Pa NWI classification none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No x (If no, explain in Remarks.)

Are Vegetation ___ Soil x or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x No ___

Are Vegetation ___ Soil ___ or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes x	No	**Is the Sampled Area within a Wetland?**	Yes x No
Hydric Soil Present?	Yes x	No		
Wetland Hydrology Present?	Yes x	No		

Remarks:

Santa Clara Conduit #11. Clear, dry weather conditions on 3/6/14. The site was revisited on 4/29/14 to identify plants that did not initially have vegetative/reproductive structures. Fill soil has likely been placed in various locations around the vault to the pipeline, and the surrounding area may have been disked in 2012 (based on aerial imagery).

Drought has resulted in drier than normal conditions. The area has received 23% of normal annual rainfall during the current growing season. Approximately 2.45" of precipitation fell during the week prior to wetland delineation survey.

VEGETATION

	Absolute Cover %	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
Total Cover:	0		
Sapling/Shrub Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
Total Cover:	0		
Herb Stratum (Plot size: 5' x 5')			
1. *Salicornia* sp.	60	Y	OBL
2. *Hordeum marinum*	15	N	FAC
3. *Plantago coronopus*	5	N	FACW
4. *Rumex crispus*	5	N	FAC
5. *Chenopodium album*	5	N	FACU
6.			
7.			
8.			
Total Cover:	90		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 10 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL Species		x 5 =
Column totals	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

x Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes x No ___

Remarks:

0.5 x 90 = 45, 0.2 x 90 = 18, FAC-neutral test: 1:1

Salicornia depressa, *S. pacifica* (syn. *Sarcocornia pacifica*), and *S. rubra* are present in Santa Clara county. All are OBL species.

SOIL

Sampling Point: 11b

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 3/1	98	5YR 5/8	2	C	M, PL	clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) **(LRR C)**
___ 1 cm Muck (A9) (**LRR D**)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
x Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If present):
Type: ____________
Depth (inches): ____________

Hydric Soil Present? Yes x **No** ____

Remarks:
Prominent redox concentrations in matrix and along pore linings in upper 12" of profile. Soil was very slightly moist throughout.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required: check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1) (**Nonriverine**)
___ Sediment Deposits (B2) (**Nonriverine**)
___ Drift Deposits (B3) (**Nonriverine**)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Plowed Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) (**Riverine**)
___ Sediment Deposits (B2) (**Riverine**)
___ Drift Deposits (B3) (Riverine)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
x Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
x FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No x Depth (inches): ____
Water Table Present? Yes ____ No x Depth (inches): ____
Saturation Present? Yes ____ No x Depth (inches): ____
(includes capillary fringe)

Wetland Hydrology Present? Yes x **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Saturation on aerial imagery from 10/6/2007, 9/29/2009, and 9/11/2011. Aerial imagery from 5/5/2012 shows that the sampling location was likely disked.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: South County Right of Way City/County: Santa Clara Sampling Date: 3/19/14
Applicant/Owner: Santa Clara Valley Water District State: CA Sampling Point: 12
Investigator(s): M. Goklany & C. Gurney Section/Township/Range: T11S,R5E,sec17
Landform (hillslope, terrace, etc.): valley Local Relief (concave, convex, none): concave Slope (%): 0
Subregion (LRR): C Lat: 36.97068 Long: -121.44125 Datum: WGS 84
Soil Map Unit Name: Pd NWI classification none
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No x (If no, explain in Remarks.)
Are Vegetation ____ Soil ____ or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes x No ____
Are Vegetation ____ Soil ____ or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes x	No	**Is the Sampled Area within a Wetland?**	Yes x No
Hydric Soil Present?	Yes x	No		
Wetland Hydrology Present?	Yes x	No		

Remarks:

Santa Clara Conduit #12. Clear, dry weather conditions. Vegetative / reproductive structures needed for plant identification to species were absent. The area was not revisited due to access issues. Regardless, hydrophytic plant species dominated the area, and hydric soil and hydrology indicators allowed us to determine that the area is a perennial marsh. Perennial marsh surrounding vault is inundated up to an upland mound / 5' high berm. The berm extends to the south along the edge of an agricultural field. Cattle and feral pigs were observed in the wetland.

Drought has resulted in drier than normal conditions. The area has received 23% of normal annual rainfall during the current growing season. Approximately 2.45" of precipitation fell 2 weeks prior to wetland delineation survey.

VEGETATION

	Absolute Cover %	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
Total Cover:			
Sapling/Shrub Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
Total Cover:			
Herb Stratum (Plot size: 5' x 5')			
1. *Typha* sp.	35	Y	OBL
2. *Persicaria* sp.	12	Y	FACW
3. *Trifolium* sp.	3	N	-
4. *Juncus mexicanus*	T	N	FACW
5.			
6.			
7.			
8.			
Total Cover:	65		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL Species		x 5 =	
Column totals	(A)		(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- x Dominance Text is >50%
- ____ Prevalence Index is ≤3.0[1]
- ____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes x No ____

Remarks:

0.5 x 65 = 32.5, 0.2 x 65 = 13, FAC-neutral test: 2:2 *Persicaria* sp. and *Trifolium* sp. did not have vegetative/reproductive structures during the 3/19/14 site visit. This location was not revisited due to access issues. *Persicaria amphibia, P. hydropiper, P. lapathifolia, P. maculosa, P. punctata* are present in Santa Clara county. All are FACW or OBL species. Unknown grasses are also present within the wetland area

SOIL

Sampling Point: 12

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-1	2.5Y 3/1	100					clay	organic soil material
1-13	10YR 4/2	50	7.5YR 4/6	7	C	M	clay	
	10YR 3/1	43						

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
_x_ Hydrogen Sulfide (A4)
____ Stratified Layers (A5) (**LRR C**)
____ 1 cm Muck (A9) (**LRR D**)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Loamy Mucky Mineral (F1)
____ Loamy Gleyed Matrix (F2)
____ Depleted Matrix (F3)
_x_ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)
____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

____ 1 cm Muck (A9) (**LRR C**)
____ 2 cm Muck (A10) (**LRR B**)
____ Reduced Vertic (F18)
____ Red Parent Material (TF2)
____ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If present):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes _x_ No ____

Remarks:

Top 1" has very greasy feel when rubbed . Soil is saturated throughout. Prominent redix concentrations throughout soil profile below 1".

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required: check all that apply)

_x_ Surface Water (A1)
_x_ High Water Table (A2)
_x_ Saturation (A3)
____ Water Marks (B1) (**Nonriverine**)
____ Sediment Deposits (B2) (**Nonriverine**)
____ Drift Deposits (B3) (**Nonriverine**)
____ Surface Soil Cracks (B6)
____ Inundation Visible on Aerial Imagery (B7)
____ Water-stained Leaves (B9)
____ Salt Crust (B11)
____ Biotic Crust (B12)
____ Aquatic Invertebrates (B13)
_x_ Hydrogen Sulfide Odor (C1)
____ Oxidized Rhizospheres along Living Roots (C3)
____ Presence of Reduced Iron (C4)
____ Recent Iron Reduction in Plowed Soils (C6)
____ Thin Muck Surface (C7)
____ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

____ Water Marks (B1) (**Riverine**)
____ Sediment Deposits (B2) (**Riverine**)
____ Drift Deposits (B3) (Riverine)
____ Drainage Patterns (B10)
____ Dry-Season Water Table (C2)
____ Crayfish Burrows (C8)
____ Saturation Visible on Aerial Imagery (C9)
____ Shallow Aquitard (D3)
____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _x_ No ____ Depth (inches): 4-12
Water Table Present? Yes _x_ No ____ Depth (inches): 2
Saturation Present? Yes _x_ No ____ Depth (inches): 0-13
(includes capillary fringe)

Wetland Hydrology Present? Yes _x_ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Hydrology is indicative of a perennial marsh wetland. Surface water covers approximately 60% of the sampling location.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: South County Right of Way City/County: San Benito Sampling Date: 3/6/14
Applicant/Owner: Santa Clara Valley Water District State: CA Sampling Point: 18
Investigator(s): M. Goklany & C. Gurney Section/Township/Range: T11S,R4E,sec13
Landform (hillslope, terrace, etc.): floodplain Local Relief (concave, convex, none): convex Slope (%): 0-1
Subregion (LRR): C Lat: 36.97918 Long: -121.48210 Datum: WGS 84
Soil Map Unit Name: Wc NWI classification none
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No x (If no, explain in Remarks.)
Are Vegetation x Soil ____ or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes x No ____
Are Vegetation ____ Soil ____ or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No x	**Is the Sampled Area within a Wetland?**	Yes		No	x
Hydric Soil Present?	Yes	No x					
Wetland Hydrology Present?	Yes	No x					

Remarks:

Santa Clara Conduit #18. Clear, dry weather conditions. Active floodplain of the Pajaro River. Sampling location adjacent is above top of bank near mound surrounding vault in agricultural field (vegetation has been disturbed by farming practices). Section of river has likely been straightened. NWI classifies channel as PUBHx.

Drought has resulted in drier than normal conditions. The area has received 23% of normal annual rainfall during the current growing season. Approximately 2.45" of precipitation fell during the week prior to wetland delineation survey.

VEGETATION

Tree Stratum (Plot size: 30' radius)	Absolute Cover %	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	0		
Sapling/Shrub Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
Total Cover:	0		
Herb Stratum (Plot size: 5' x 5')			
1. *Avena* sp.	50	Y	UPL
2. *Brassica nigra*	30	Y	UPL
3. *Festuca perennis* (*Lolium perenne*)	10	N	FAC
4.			
5.			
6.			
7.			
8.			
Total Cover:	90		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 10 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	10	x 3 =	30
FACU species		x 4 =	
UPL Species	80	x 5 =	400
Column totals	90 (A)		430 (B)

Prevalence Index = B/A = 4.8

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ____ No x

Remarks:

0.5 x 90 = 45, 0.2 x 90 = 18, FAC-neutral test: 0:0

Farming practices have altered the vegetative community at this location, and *Avena* sp. has possibly been planted for livestock feed.

SOIL

Sampling Point: 18

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	2.5Y 2.5/1	90					clay	many fine roots in top 5"
	10YR 5/6	10					clay	
8-17	2.5Y 2.5/1	70					clay	
	10YR 5/6	30					clay	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) **(LRR C)**
___ 1 cm Muck (A9) (**LRR D**)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If present):
Type: ____________________
Depth (inches): ____________________

Hydric Soil Present? Yes ______ **No** x

Remarks:
No hydric indicators.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required: check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1) (**Nonriverine**)
___ Sediment Deposits (B2) (**Nonriverine**)
___ Drift Deposits (B3) (**Nonriverine**)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Plowed Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) (**Riverine**)
___ Sediment Deposits (B2) (**Riverine**)
___ Drift Deposits (B3) (Riverine)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:
Surface Water Present? Yes ______ No x Depth (inches): ______
Water Table Present? Yes ______ No x Depth (inches): ______
Saturation Present? Yes ______ No x Depth (inches): ______
(includes capillary fringe)

Wetland Hydrology Present? Yes ______ **No** x

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No hydrology indicators.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: South County Right of Way City/County: San Benito County Sampling Date: 3/5/14 and 5/1/14
Applicant/Owner: Santa Clara Valley Water District State: CA Sampling Point: 19a
Investigator(s): M. Goklany & C. Gurney Section/Township/Range: T11S,R4E,sec13
Landform (hillslope, terrace, etc.): River bed Local Relief (concave, convex, none): concave Slope (%): 0-1
Subregion (LRR): C Lat: 36.98074 Long: -121.48922 Datum: WGS 84
Soil Map Unit Name: Wc NWI classification none
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No x (If no, explain in Remarks.)
Are Vegetation ____ Soil ____ or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes x No ____
Are Vegetation ____ Soil ____ or Hydrology x naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes x No ____	**Is the Sampled Area within a Wetland?**	Yes x No ____
Hydric Soil Present?	Yes x No ____		
Wetland Hydrology Present?	Yes x No ____		

Remarks:
Santa Clara Conduit #19. Clear, dry weather conditions on 3/5/14. The site was revisited on 5/1/14 to identify plants that did not initially have vegetative/reproductive structures. In-channel seasonal wetland in ephemeral section of the Pajaro River. Section of river has likely been straightened.
Drought has resulted in drier than normal conditions. The area has received 23% of normal annual rainfall during the current growing season. Approximately 2.45" of precipitation fell during the week prior to wetland delineation survey.

VEGETATION

Tree Stratum (Plot size: 30' radius)	Absolute Cover %	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	0		
Sapling/Shrub Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
Total Cover:	0		
Herb Stratum (Plot size: 5' x 5')			
1. *Distichlis spicata*	80	Y	FAC
2. *Cressa truxillensis*	7	N	FACW
3. *Salicornia* sp.	1	N	OBL
4. *Festuca perennis* (*Lolium perenne*)	10	N	FAC
5. *Bromus diandrus*	2	N	UPL
6.			
7.			
8.			
Total Cover:	100		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL Species		x 5 =
Column totals	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

x Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? **Yes** x **No** ____

Remarks:
0.5 x 100 = 50, 0.2 x 100 = 20, FAC-neutral test = 0:0
Sampling location was within OHWs of the Pajaro River. *Salicornia depressa*, *S. pacifica* (syn. *Sarcocornia pacifica*), and *S. rubra* are present in San Benito county. All are OBL species.

SOIL

Sampling Point: 19a

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-13	2.5Y 3/1	85	5YR 3/4	2	C	M	clay	many fine roots in top 5"
	2.5Y 4/4	13						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) **(LRR C)**
___ 1 cm Muck (A9) **(LRR D)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
_x_ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) **(LRR C)**
___ 2 cm Muck (A10) **(LRR B)**
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If present):
Type: ______
Depth (inches): ______

Hydric Soil Present? Yes _x_ No ___

Remarks:
Soil slightly moist throughout. Distinct redox concentrations in upper 12" of soil pit.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required: check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1) **(Nonriverine)**
___ Sediment Deposits (B2) **(Nonriverine)**
___ Drift Deposits (B3) **(Nonriverine)**
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Plowed Soils (C6)
___ Thin Muck Surface (C7)
Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) **(Riverine)**
___ Sediment Deposits (B2) **(Riverine)**
___ Drift Deposits (B3) (Riverine)
_x_ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
_x_ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No _x_ Depth (inches): ___
Water Table Present? Yes ___ No _x_ Depth (inches): ___
Saturation Present? Yes ___ No _x_ Depth (inches): ___
(includes capillary fringe)

Wetland Hydrology Present? Yes _x_ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Vegetation matted in one direction. Saturation visiable on aerial imagery from 12/30/2005, 8/4/2006, 9/30/2009, and 2/2/2010.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: South County Right of Way City/County: San Benito County Sampling Date: 3/5/14 and 5/1/14
Applicant/Owner: Santa Clara Valley Water District State: CA Sampling Point: 19b
Investigator(s): M. Goklany & C. Gurney Section/Township/Range: T11S,R4E,sec13
Landform (hillslope, terrace, etc.): flooplain Local Relief (concave, convex, none): slightly convex Slope (%): 0-2
Subregion (LRR): C Lat: 36.98072 Long: -121.48926 Datum: WGS 84
Soil Map Unit Name: Wc NWI classification none
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No x (If no, explain in Remarks.)
Are Vegetation ____ Soil ____ or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes x No ____
Are Vegetation ____ Soil ____ or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No x	Is the Sampled Area within a Wetland?	Yes ____ No x
Hydric Soil Present?	Yes ____ No x		
Wetland Hydrology Present?	Yes ____ No x		

Remarks:

Santa Clara Conduit #19. Clear, dry weather conditions on 3/5/14. The site was revisited on 4/29/14 to identify plants that did not initially have vegetative/reproductive structures. Active floodplain of the Pajaro River. NWI classifies channel as PUSCx. Upland sampling location above top of bank adjacent to mound surrounding vault.

Drought has resulted in drier than normal conditions. The area has received 23% of normal annual rainfall during the current growing season. Approximately 2.45" of precipitation fell during the week prior to wetland delineation survey.

VEGETATION

Tree Stratum (Plot size: 30' radius)	Absolute Cover %	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	0		
Sapling/Shrub Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
Total Cover:	0		
Herb Stratum (Plot size: 5' x 5')			
1. *Bromus diandrus*	45	Y	UPL
2. *Hordeum marinum*	35	Y	FAC
3. *Sonchus asper*	3	N	FAC
4. *Bromus hordeaceus*	10	N	FACU
5. *Carduus pycnocephalus*	3	N	UPL
6. *Geranium molle*	T	N	UPL
7. *Festuca perennis* (*Lolium perenne*)	15		FAC
8.			
Total Cover:	111		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	50	(A/B)

Prevalence Index worksheet:

Total % Cover of:			Multiply by:
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	53	x 3 =	159
FACU species	10	x 4 =	40
UPL Species	48	x 5 =	240
Column totals	111	(A)	439 (B)

Prevalence Index = B/A = 3.9

Hydrophytic Vegetation Indicators:

____ Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ____ No x

Remarks:

0.5 x 111 = 55.5, 0.2 x 111 = 22.2, FAC-neutral test = 0:1

SOIL

Sampling Point: 19b

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-13	2.5Y 3/1	70					clay loam	many fine roots in top 4"
	2.5Y 4/5	25						
	10YR 4/4	5						

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains

[2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) (**LRR C**)
___ 1 cm Muck (A9) (**LRR D**)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ **No** x

Remarks:

No hydric indicators. Soil was very slightly moist throughout.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required: check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1) (**Nonriverine**)
___ Sediment Deposits (B2) (**Nonriverine**)
___ Drift Deposits (B3) (**Nonriverine**)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Plowed Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) (**Riverine**)
___ Sediment Deposits (B2) (**Riverine**)
___ Drift Deposits (B3) (Riverine)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No x Depth (inches): ___
Water Table Present? Yes ___ No x Depth (inches): ___
Saturation Present? Yes ___ No x Depth (inches): ___
(includes capillary fringe)

Wetland Hydrology Present? Yes ___ **No** x

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No hydrology indicators.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: South County Right of Way City/County: Santa Clara County Sampling Date: 3/5/14
Applicant/Owner: Santa Clara Valley Water Distrct State: CA Sampling Point: 20
Investigator(s): M. Goklany & C. Gurney Section/Township/Range: T11S,R4E,sec11
Landform (hillslope, terrace, etc.): valley floor Local Relief (concave, convex, none): none Slope (%): 0-1
Subregion (LRR): C Lat: 36.98442 Long: -121.49735 Datum: WGS 84
Soil Map Unit Name: Ck NWI classification none
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No x (If no, explain in Remarks.)
Are Vegetation x Soil ___ or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x No ___
Are Vegetation ___ Soil ___ or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes x	No ___	**Is the Sampled Area within a Wetland?**	Yes ___ No x
Hydric Soil Present?	Yes ___	No x		
Wetland Hydrology Present?	Yes ___	No x		

Remarks:
Santa Clara Conduit #20. Clear, dry weather conditions. Sampling location in agricultural field. Natural vegetation has been replaced by *F. perennis* crop. Drought has resulted in drier than normal conditions. The area has received 23% of normal annual rainfall during the current growing season. Approximately 2.45" of precipitation fell during the week prior to wetland delineation survey.

VEGETATION

Tree Stratum (Plot size: 30' radius)	Absolute Cover %	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	0		
Sapling/Shrub Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
Total Cover:	0		
Herb Stratum (Plot size: 5' x 5')			
1. *Festuca perennis* (*Lolium perenne*)	90	Y	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	90		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 10 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	___	x 1 = ___
FACW species	___	x 2 = ___
FAC species	___	x 3 = ___
FACU species	___	x 4 = ___
UPL Species	___	x 5 = ___
Column totals	___ (A)	___ (B)

Prevalence Index = B/A = ___

Hydrophytic Vegetation Indicators:

x Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes x No ___

Remarks:
Monoculture of *F. perennis* for livestock feed.

SOIL

Sampling Point: 20

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 3/1	85					clay loam	Many fine roots in top layer
	10YR 4/4	15					clay loam	
5-15	7.5YR 4/6	5					sand	
	10YR 4/4	35					clay loam	
	10YR 3/1	60					clay loam	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains

[2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) (**LRR C**)
___ 1 cm Muck (A9) (**LRR D**)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No x

Remarks:

No hydric indicators.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required: check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1) (**Nonriverine**)
___ Sediment Deposits (B2) (**Nonriverine**)
___ Drift Deposits (B3) (**Nonriverine**)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Plowed Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) (**Riverine**)
___ Sediment Deposits (B2) (**Riverine**)
___ Drift Deposits (B3) (Riverine)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
x Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No x Depth (inches): ___
Water Table Present? Yes ___ No x Depth (inches): ___
Saturation Present? Yes ___ No x Depth (inches): ___
(includes capillary fringe)

Wetland Hydrology Present? Yes ___ No x

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No hydrology indicators.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: South County Right of Way City/County: Santa Clara Sampling Date: 3/6/14 and 4/29/14
Applicant/Owner: Santa Clara Valley Water District State: CA Sampling Point: 21a
Investigator(s): M. Goklany & C. Gurney Section/Township/Range: T11S,R4E,sec11
Landform (hillslope, terrace, etc.): floodplain Local Relief (concave, convex, none): none Slope (%): 0-1
Subregion (LRR): C Lat: 36.98870 Long: -121.50096 Datum: WGS 84
Soil Map Unit Name: Ck NWI classification none
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No x (If no, explain in Remarks.)
Are Vegetation ____ Soil ____ or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes x No ____
Are Vegetation x Soil ____ or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes x	No	Is the Sampled Area within a Wetland?	Yes x No
Hydric Soil Present?	Yes x	No		
Wetland Hydrology Present?	Yes x	No		

Remarks:

Santa Clara Conduit #21. Clear, dry weather conditions on 3/6/14. The site was revisited on 4/29/14 to identify plants that did not initially have vegetative/reproductive structures. Mound surrounding vault has been coverted to upland. The surrounding area is all seasonal wetland. Hummocks were present at this sampling location.

Drought has resulted in drier than normal conditions. The area has received 23% of normal annual rainfall during the current growing season. Approximately 2.45" of precipitation fell during the week prior to wetland delineation survey.

VEGETATION

Tree Stratum (Plot size: 30' radius)	Absolute Cover %	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	0		
Sapling/Shrub Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
Total Cover:	0		
Herb Stratum (Plot size: 5' x 5')			
1. *Festuca perennis* (*Lolium perenne*)	90	Y	FAC
2. *Trifolium repens*	25	N	FACU
3. *Rumex conglomeratus*	1	N	FACW
4. *Juncus mexicanus*	1	N	FACW
5. *Plantago lanceolata*	T	N	FAC
6. *Polypogon monspeliensis*	10	N	FACW
7.			
8.			
Total Cover:	127		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL Species		x 5 =
Column totals	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

x Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes x No ____

Remarks:

0.5 x 132 = 66, 0.2 x 132 = 26.4, FAC-neutral test: 0:0

SOIL

Sampling Point: 21a

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/1	98	10YR 4/6	2	C	M	clay loam	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) **(LRR C)**
___ 1 cm Muck (A9) (**LRR D**)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
x Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes x No ___

Remarks:

Soil is very moist. Slightly more clay in bottom 3" of profile. Prominent redox concentrations in upper 10" of profile.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required: check all that apply)

x Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1) (**Nonriverine**)
___ Sediment Deposits (B2) (**Nonriverine**)
___ Drift Deposits (B3) (**Nonriverine**)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Plowed Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) (**Riverine**)
___ Sediment Deposits (B2) (**Riverine**)
___ Drift Deposits (B3) (Riverine)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes x No ___ Depth (inches): 2
Water Table Present? Yes ___ No x Depth (inches): ___
Saturation Present? Yes ___ No x Depth (inches): ___
(includes capillary fringe)

Wetland Hydrology Present? Yes x No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Approximately 10% of the impact area at this sampling location was covered by surface water in lower areas between hummucks.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: South County Right of Way City/County: Santa Clara Sampling Date: 3/6/14 and 4/29/14
Applicant/Owner: Santa Clara Valley Water District State: CA Sampling Point: 21b
Investigator(s): M. Goklany & C. Gurney Section/Township/Range: T11S,R4E,sec11
Landform (hillslope, terrace, etc.): floodplain Local Relief (concave, convex, none): convex Slope (%): 0-2
Subregion (LRR): C Lat: 36.98872 Long: -121.50099 Datum: WGS 84
Soil Map Unit Name: Ck NWI classification none
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No x (If no, explain in Remarks.)
Are Vegetation ___ Soil ___ or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x No ___
Are Vegetation ___ Soil ___ or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No x	**Is the Sampled Area within a Wetland?**	Yes ___ No x
Hydric Soil Present?	Yes	No x		
Wetland Hydrology Present?	Yes	No x		

Remarks:

Santa Clara Conduit #21. Clear, dry weather conditions on 3/6/14. The site was revisited on 4/29/14 to identify plants that did not initially have vegetative/reproductive structures. Mound surrounding vault has been coverted to upland, and the surrounding area is all seasonal wetland.

Drought has resulted in drier than normal conditions. The area has received 23% of normal annual rainfall during the current growing season. Approximately 2.45" of precipitation fell during the week prior to wetland delineation survey.

VEGETATION

	Absolute Cover %	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
Total Cover:	0		
Sapling/Shrub Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
Total Cover:	0		
Herb Stratum (Plot size: 5' x 5')			
1. *Hordeum murinum*	12	Y	FACU
2. *Hordeum marinum*	6	Y	FAC
3. *Malva nicaeensis*	5	N	UPL
4. *Festuca perennis* (*Lolium perenne*)	4	N	FAC
5. *Sonchus asper*	2	N	FAC
6. *Plantago lanceolata*	1	N	FAC
7.			
8.			
Total Cover:	30		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 68 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	50	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	7	x 3 = 21
FACU species	18	x 4 = 72
UPL Species	5	x 5 = 25
Column totals	30 (A)	118 (B)

Prevalence Index = B/A = 3.9

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ___ No x

Remarks:

0.5 x 30 = 15, 0.2 x 30 = 6, FAC-neutral: 0:0

SOIL

Sampling Point: 21b

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/1	100					clay loam	
4-18	10YR 3/1	83					clay	
	10YR 4/6	15					silt	
	10YR 2/1	2	10YR 4/6	2	C	M	clay	redox only in bottom 6" of profile

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) (**LRR C**)
___ 1 cm Muck (A9) (**LRR D**)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If present):

Type:

Depth (inches):

Hydric Soil Present? Yes ___ No x

Remarks:

Soil was very dry throughout. No hydric indicators.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required: check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1) (**Nonriverine**)
___ Sediment Deposits (B2) (**Nonriverine**)
___ Drift Deposits (B3) (**Nonriverine**)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Plowed Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) (**Riverine**)
___ Sediment Deposits (B2) (**Riverine**)
___ Drift Deposits (B3) (Riverine)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No x Depth (inches): ___
Water Table Present? Yes ___ No x Depth (inches): ___
Saturation Present? Yes ___ No x Depth (inches): ___
(includes capillary fringe)

Wetland Hydrology Present? Yes ___ No x

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No hydrology indicators.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: South County Right of Way City/County: Santa Clara County Sampling Date: 3/5/14
Applicant/Owner: Santa Clara Valley Water District State: CA Sampling Point: 52a
Investigator(s): M. Goklany & C. Gurney Section/Township/Range: T9S,R3E,sec36
Landform (hillslope, terrace, etc.): floodplain Local Relief (concave, convex, none): none Slope (%): 0-1
Subregion (LRR): C Lat: 37.10411 Long: -121.58318 Datum: WGS 84
Soil Map Unit Name: CrC NWI classification none
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No x (If no, explain in Remarks.)
Are Vegetation ___ Soil ___ or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x No ____
Are Vegetation ___ Soil ___ or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes x No ____	Is the Sampled Area within a Wetland?	Yes x No ____
Hydric Soil Present?	Yes x No ____		
Wetland Hydrology Present?	Yes x No ____		

Remarks:

Santa Clara Conduit #52. Clear, dry conditions. Sampling area in floodplain of San Martin, near Martin Murphy Trail in Coyote Lake - Harvey Bear County Park. This location is a mosaic of seasonal wetland/upland prairie, and approximately 75% of the sample area is dominated by hydrophytes, and has hydric soil and hydrology indicators.

Drought has resulted in drier than normal conditions. The area has received 23% of normal annual rainfall during the current growing season. Approximately 2.45" of precipitation fell during the week prior to wetland delineation survey.

VEGETATION

Tree Stratum (Plot size: 30' radius)	Absolute Cover %	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	0		
Sapling/Shrub Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
Total Cover:	0		
Herb Stratum (Plot size: 5' x 5')			
1. *Hordeum marinum*	35	Y	FAC
2. *Festuca perennis* (*Lolium perenne*)	35	Y	FAC
3. *Juncus xiphioides*	20	Y	OBL
4. *Polypogon monspeliensis*	10	N	FACW
5. *Rumex crispus*	1	N	FAC
6. *Geranium dissectum*	T	N	UPL
7. *Cyperus eragrostis*	T	N	FACW
8. *Helminthotheca echioides*	T	N	UPL
Total Cover:	101		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL Species		x 5 =
Column totals	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

x Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes x No ____

Remarks:

0.5 x 101 = 50.2, 0.2 x 101 = 20.2, FAC-neutral test: 0:0

Grasses and forbs were beginning to green-up. *J. xiphioides* (perennial) was mostly dead, potentially from experiencing several years of drought. Concentrations of *J. xiphioides*, *P. monspeliensis*, and *C. eragrostis* were used to determine the wetland/upland boundary.

SOIL

Sampling Point: 52a

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-15	10YR 4/1	95	5YR 4/6	2	C	PL	silty clay loam	
	10YR 4/2	3						

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains

[2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- x Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes x No ___

Remarks:

Prominent redox concentrations throughout soil profile along pore linings. Soil was saturated throughout profile. Two more exploratory pits were dug along the wetland/upland boundary.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required: check all that apply)

- x Surface Water (A1)
- x High Water Table (A2)
- x Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (Riverine)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes x No ___ Depth (inches): 2

Water Table Present? Yes x No ___ Depth (inches): 6

Saturation Present? (includes capillary fringe) Yes x No ___ Depth (inches): 0-15

Wetland Hydrology Present? Yes x No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Surface water on 10% of the sample area, mostly surrounding the vault, but small depressions with water were scattered across the area.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: South County Right of Way City/County: Santa Clara Sampling Date: 3/5/14
Applicant/Owner: Santa Clara Valley Water District State: CA Sampling Point: 52b
Investigator(s): M. Goklany & C. Gurney Section/Township/Range: T9S,R3E,sec36
Landform (hillslope, terrace, etc.): floodplain Local Relief (concave, convex, none): none Slope (%): 0-1
Subregion (LRR): C Lat: 37.10419 Long: -121.58323 Datum: WGS 84
Soil Map Unit Name: CrC NWI classification none
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No x (If no, explain in Remarks.)
Are Vegetation ____ Soil ____ or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes x No ____
Are Vegetation ____ Soil ____ or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	x	No		**Is the Sampled Area within a Wetland?**	Yes	No	x
Hydric Soil Present?	Yes		No	x				
Wetland Hydrology Present?	Yes		No	x				

Remarks:

Santa Clara Conduit #52. Sunny, dry conditions. Sampling area in floodplain of San Martin, near Martin Murphy Trail in Coyote Lake - Harvey Bear County Park. This location is a mosaic of wetland/upland prairie, and approximately 25% of the sample area is upland.

Drought has resulted in drier than normal conditions. The area has received 23% of normal annual rainfall during the current growing season. Approximately 2.45" of precipitation fell during the week prior to wetland delineation survey.

VEGETATION

Tree Stratum (Plot size: 30' radius)	Absolute Cover %	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	0		
Sapling/Shrub Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
Total Cover:	0		
Herb Stratum (Plot size: 5' x 5')			
1. *Festuca perennis* (*Lolium perenne*)	60	Y	FAC
2. *Hordeum marinum*	30	Y	FAC
3. *Vicia sativa*	5	N	FACU
4. *Brassica nigra*	2	N	UPL
5. *Medicago polymorpha*	25	Y	FACU
6. *Helminthotheca echioides*	3	N	UPL
7.			
8.			
Total Cover:	125		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	66.7	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL Species	x 5 =	
Column totals	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

x Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes x No ____

Remarks:

0.5 x 125 = 62.5, 0.2 x 97 = 19.4, FAC-neutral test: 0:0

Grasses and forbs were beginning to green-up.

SOIL

Sampling Point: 52b

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 3/1	100					clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) (**LRR C**)
___ 1 cm Muck (A9) (**LRR D**)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If present):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes____ No x

Remarks:

No hydric indicators. Soil was slightly moist throughout.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required: check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1) (**Nonriverine**)
___ Sediment Deposits (B2) (**Nonriverine**)
___ Drift Deposits (B3) (**Nonriverine**)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Plowed Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) (**Riverine**)
___ Sediment Deposits (B2) (**Riverine**)
___ Drift Deposits (B3) (Riverine)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes____ No x Depth (inches):____
Water Table Present? Yes____ No x Depth (inches):____
Saturation Present? Yes____ No x Depth (inches):____
(includes capillary fringe)

Wetland Hydrology Present? Yes____ No x

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No hydrology indicators. Microtopography of the sampling location has created a mosaic of upland/wetland. This sampling point was slightly more elevated than the wetland pit, and conditions were substantially drier.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: South County Right of Way City/County: Santa Clara County Sampling Date: 3/11/14
Applicant/Owner: Santa Clara Valley Water District State: CA Sampling Point: 54
Investigator(s): M. Goklany & C. Gurney Section/Township/Range: T9S,R3E,sec36
Landform (hillslope, terrace, etc.): ephemeral drainage Local Relief (concave, convex, none): slightly concave Slope (%): 0-1
Subregion (LRR): C Lat: 37.11520 Long: -121.59886 Datum: WGS 84
Soil Map Unit Name: CrA NWI classification none
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No x (If no, explain in Remarks.)
Are Vegetation ___ Soil ___ or Hydrology x significantly disturbed? Are "Normal Circumstances" present? Yes x No ___
Are Vegetation ___ Soil ___ or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ___ No x
Hydric Soil Present? Yes ___ No x
Wetland Hydrology Present? Yes x No ___

Is the Sampled Area within a Wetland? Yes ___ No x

Remarks:

Santa Clara Conduit #54. Roadside/irrigation ditch is manmade, currently maintained, and intersects with Corralitos Creek approximately 200' north of the sampling location (waters of the U.S.). Sample point located on sparsely vegetated bed of ephemeral drainage at the edge of an agricultural field.

Drought has resulted in drier than normal conditions. The area has received 23% of normal annual rainfall during the current growing season. Approximately 2.45" of precipitation fell during the week prior to wetland delineation survey.

VEGETATION

Tree Stratum (Plot size: 30' radius)	Absolute Cover %	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	0		
Sapling/Shrub Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
Total Cover:	0		
Herb Stratum (Plot size: 5' x 5')			
1. *Festuca perennis* (*Lolium perenne*)	5	Y	FAC
2. *Hordeum murinum*	5	Y	FACU
3. *Bromus diandrus*	3	Y	UPL
4. *Cichorium intybus*	2	Y	UPL
5. *Convolvulus arvensis*	T	N	UPL
6. *Rumex crispus*	T	N	FAC
7. *Lamium amplexicaule*	T	N	UPL
8. *Taraxacum officinale*	T	N	FACU
Total Cover:	10		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 90 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 4 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 25 (A/B)

Prevalence Index worksheet:

Total % Cover of:			Multiply by:
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	5	x 3 =	15
FACU species	5	x 4 =	20
UPL Species	5	x 5 =	25
Column totals	15	(A)	60 (B)

Prevalence Index = B/A = 4.0

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ___ No x

Remarks:

0.5 x 10 = 5, 0.2 x 10 = 2, FAC-neutral test: 0:3

Grasses and forbs were beginning to green up. Vegetation is likely rountinely removed from drainage.

SOIL

Sampling Point: 54

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-13	10YR 3/1	100					clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) (**LRR C**)
___ 1 cm Muck (A9) (**LRR D**)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If present):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? **Yes** ____ **No** x

Remarks:

Soil slightly moist throughout. No hydric indicators.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required: check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1) (**Nonriverine**)
___ Sediment Deposits (B2) (**Nonriverine**)
___ Drift Deposits (B3) (**Nonriverine**)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Plowed Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) (**Riverine**)
___ Sediment Deposits (B2) (**Riverine**)
___ Drift Deposits (B3) (Riverine)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No x Depth (inches): ____
Water Table Present? Yes ____ No x Depth (inches): ____
Saturation Present? Yes ____ No x Depth (inches): ____
(includes capillary fringe)

Wetland Hydrology Present? Yes x No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No hydrology indicators.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: South County Right of Way City/County: Santa Clara County Sampling Date: 3/5/14 and 4/29/14
Applicant/Owner: Santa Clara Valley Water District State: CA Sampling Point: 57a
Investigator(s): M. Goklany & C. Gurney Section/Township/Range: T9S,R3E,sec26
Landform (hillslope, terrace, etc.): floodplain Local Relief (concave, convex, none): slightly convex Slope (%): 0-2
Subregion (LRR): C Lat: 37.12534 Long: -121.60671 Datum: WGS 84
Soil Map Unit Name: SdA and HfC NWI classification R4SBC
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No x (If no, explain in Remarks.)
Are Vegetation ____ Soil ____ or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes x No ____
Are Vegetation ____ Soil ____ or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No x	Is the Sampled Area within a Wetland?	Yes ____ No x
Hydric Soil Present?	Yes ____	No x		
Wetland Hydrology Present?	Yes ____	No x		

Remarks:

Santa Clara Conduit #57. Partly cloudy, dry conditions on 3/5/14. The site was revisited on 4/29/14 to identify plants that did not initially have vegetative/reproductive structures. Sampling on upland terrace above in ephemeral section of Tennant Creek next to livestock pen.

Drought has resulted in drier than normal conditions. The area has received 23% of normal annual rainfall during the current growing season. Approximately 2.45" of precipitation fell during the week prior to wetland delineation survey.

VEGETATION

	Absolute Cover %	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30' radius)			
1. *Juglans hindsii*	10	Y	FAC
2. *Quercus agrifolia*	6	Y	UPL
3. *Cinnamomum camphora*	8	Y	UPL
4.			
Total Cover:	24		
Sapling/Shrub Stratum (Plot size: 30' radius)			
1. *Baccharis pilularis*	2	N	UPL
2. *Prunus caroliniana*	4	Y	FACU
3. *Prunus subcordata*	5	Y	UPL
4.			
5.			
Total Cover:	11		
Herb Stratum (Plot size: 5' x 5')			
1. *Vicia sativa*	20	Y	FACU
2. *Bromus diandrus*	25	Y	UPL
3. *Geranium molle*	1	N	UPL
4. *Festuca perennis* (*Lolium perenne*)	10	N	UPL
5. *Rumex conglomeratus*	3	N	FACW
6. *Avena* sp.	8	N	UPL
7. *Tragopogon porrifolius*	2	N	UPL
8. *Raphanus sativus*	15	N	UPL
Total Cover:	84		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 16 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	7	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0	(A/B)

Prevalence Index worksheet:

Total % Cover of:			Multiply by:	
OBL species		x 1 =		
FACW species	3	x 2 =	6	
FAC species	10	x 3 =	30	
FACU species	24	x 4 =	96	
UPL Species	44	x 5 =	220	
Column totals	81	(A)	433	(B)

Prevalence Index = B/A = 5.3

Hydrophytic Vegetation Indicators:

____ Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ____ No x

Remarks:

Trees: 0.5 x 24 = 12, 0.2 x 24 = 4.8, Shrubs: 0.5 x 11 = 5.5, 0.2 x 11 = 2.2, Herbs: 0.5 x 84 = 42, 0.2 x 84 = 16.8, FAC-neutral test: 0:6
Vegetation sampling area was above OHWs of Tennant Creek.

SOIL

Sampling Point: 57a

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-9	10YR 3/2	75					clay loam	
	7.5YR 4/3	25					clay loam	many small and medium gravels
9-13	7.5YR 4/3	100						

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains

[2] Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) (**LRR C**)
___ 1 cm Muck (A9) (**LRR D**)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ____ No x

Remarks:

Soil moist throughout. No hydric indicators.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required: check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1) (**Nonriverine**)
___ Sediment Deposits (B2) (**Nonriverine**)
___ Drift Deposits (B3) (**Nonriverine**)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Plowed Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) (**Riverine**)
___ Sediment Deposits (B2) (**Riverine**)
___ Drift Deposits (B3) (Riverine)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No x Depth (inches): ____
Water Table Present? Yes ____ No x Depth (inches): ____
Saturation Present? Yes ____ No x Depth (inches): ____
(includes capillary fringe)

Wetland Hydrology Present? Yes ____ No x

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Soil moist throughout, but not glistening. No hydrology indicators.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project Site: South County Right of Way City/County: Santa Clara County Sampling Date: 3/5/14 and 4/29/14
Applicant/Owner: Santa Clara Valley Water District State: CA Sampling Point: 57b
Investigator(s): M. Goklany & C. Gurney Section/Township/Range: T9S,R3E,sec26
Landform (hillslope, terrace, etc.): Streambed Local Relief (concave, convex, none): slightly concave Slope (%): ____
Subregion (LRR): C Lat: 37.12532 Long: -121.60666 Datum: WGS 84
Soil Map Unit Name: SdA and HfC NWI classification R4SBC
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No x (If no, explain in Remarks.)
Are Vegetation ____ Soil ____ or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes x No ____
Are Vegetation ____ Soil ____ or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes x	No	**Is the Sampled Area within a Wetland?**	Yes x No
Hydric Soil Present?	Yes x	No		
Wetland Hydrology Present?	Yes x	No		

Remarks:

Santa Clara Conduit #57. Partly cloudy, dry conditions on 3/5/14. The site was revisited on 4/29/14 to identify plants that did not initially have vegetative/reproductive structures. Seasonal wetland in ephemeral stream channel (Tennant Creek) near to livestock pen and dirt path that crosses stream.

Third consecutive year of drought. Drought has resulted in drier than normal conditions. The area has received 23% of normal annual rainfall during the current growing season. Approximately 2.45" of precipitation fell during the week prior to wetland delineation survey.

VEGETATION

Tree Stratum (Plot size: 30' radius)	Absolute Cover %	Dominant Species?	Indicator Status
1. *Cinnamomum camphora*	5	Y	UPL
2. *Juglans hindsii*	2	Y	FAC
3.			
4.			
Total Cover:	7		
Sapling/Shrub Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
Total Cover:	0		
Herb Stratum (Plot size: 5' x 5')			
1. *Rumex conglomeratus*	3	N	FACW
2. *Geranium molle*	T	N	UPL
3. *Raphanus sativus*	5	N	UPL
4. *Mentha spicata*	40	Y	OBL
5. *Bromus catharticus*	8	N	UPL
6. *Plantago lanceolata*	2	N	FAC
7. *Agrostis stolonifera*	10	N	FACW
8.			
Total Cover:	68		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
Total Cover:			
% Bare Ground in Herb Stratum 80	% Cover of Biotic Crust 0		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	66.7	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL Species		x 5 =
Column totals	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

x Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes x No ____

Remarks:
Trees: 0.5 x 7 = 3.5, 0.2 x 7 = 1.4, Herbs: 0.5 x 68 = 34, 0.2 x 20 = 13.6, FAC-neutral test 1:2.
Sampling location was within OHWs of Tennant Creek.

SOIL

Sampling Point: 57b

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 3/2	82	5YR 4/6	18	C	M	silty clay loam	
10-13	10YR 3/2	90	5YR 4/6	10	C	M	silty clay loam	trace amount of sandy inclusions, many small and medium gravels

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) **(LRR C)**
___ 1 cm Muck (A9) **(LRR D)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
_x_ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) **(LRR C)**
___ 2 cm Muck (A10) **(LRR B)**
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______
Depth (inches): ______

Hydric Soil Present? Yes _x_ No ___

Remarks:

Soil moist throughout. Prominent redox concentrations throughout.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required: check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1) **(Nonriverine)**
___ Sediment Deposits (B2) **(Nonriverine)**
___ Drift Deposits (B3) **(Nonriverine)**
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
_x_ Water-stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Plowed Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) **(Riverine)**
___ Sediment Deposits (B2) **(Riverine)**
___ Drift Deposits (B3) (Riverine)
_x_ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No _x_ Depth (inches): ___
Water Table Present? Yes ___ No _x_ Depth (inches): ___
Saturation Present? Yes ___ No _x_ Depth (inches): ___
(includes capillary fringe)

Wetland Hydrology Present? Yes _x_ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Vegetation matted in one direction. 2" of surface water in puddle on manmade pathway over channel from recent rainfall. No surface water within OHWs of Tennant Creek. Soil was moist, but not glistening.

Appendix D. Arid West OHWM Data Forms

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: South Co. Right of Way
Project Number: 3270-35
Stream: ES8
Investigator(s): M. Goklany

Date: 3/6/14
Town: San Benito Co.
Photo begin file#:

Time: 2:30 pm
State: CA
Photo end file#:

Y ☐ / N ☒ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: unnamed ephemeral stream

Projection:
Datum: WGS84
Coordinates:

Potential anthropogenic influences on the channel system:
Area currently used for cattle grazing.
Normal circumstances are not present due to drought

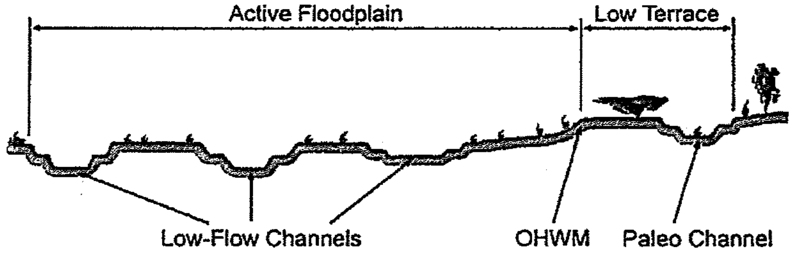
Brief site description:
Drainage is in annual grassland + connects to Ortega Creek to the East
No standing/flowing water. Vault SCC#8 is in active floodplain.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: 2005-2013
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☒ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☒ Global positioning system (GPS)
- ☐ Other studies

- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

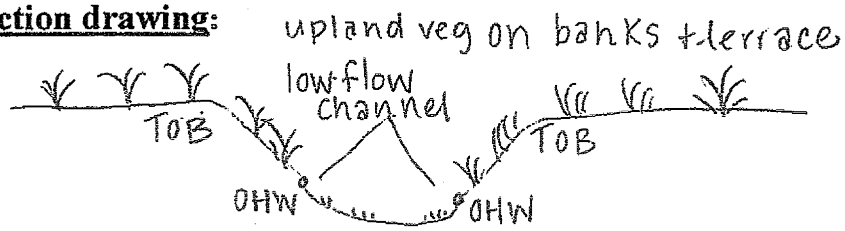


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   ☐ Mapping on aerial photograph ☒ GPS
   ☐ Digitized on computer ☐ Other:

Project ID: 3270-35 **Cross section ID:** ES8 **Date:** 3/6/14 **Time:** 2:30 pm

Cross section drawing:



OHWM

GPS point: OHW8A - 36.97460/-121.41513
OHW8B - 36.95459/-121.41513

Indicators:
☐ Change in average sediment texture
☐ Change in vegetation species
☒ Change in vegetation cover
☒ Break in bank slope
☐ Other: __________
☐ Other: __________

Comments:
Soil substrate in streambed w/ upland vegetation similar to that of banks + top of bank. Slight break in slope and less vegetative cover at/below OHW's.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: same as above

Characteristics of the floodplain unit:
Average sediment texture: clay loam/medium silt
Total veg cover: 40 % Tree: 0 % Shrub: 0 % Herb: 40 %
Community successional stage:
☐ NA
☒ Early (herbaceous & seedlings)
☐ Mid (herbaceous, shrubs, saplings)
☐ Late (herbaceous, shrubs, mature trees)

Indicators:
☐ Mudcracks
☐ Ripples
☐ Drift and/or debris
☒ Presence of bed and bank
☐ Benches
☐ Soil development
☐ Surface relief
☐ Other: __________
☐ Other: __________
☐ Other: __________

Comments:
Low-flow channel corresponds to OHW's.
70% cover of grasses + forbs above OHW.
Upper terrace would recieve flows in 100-yr events.

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: South Co. Right of Way
Project Number: 3270-35
Stream: SW19
Investigator(s): M. Goklany
Date: 3/6/14
Time: 930 am
Town: Santa Clara Co.
State: CA
Photo begin file#:
Photo end file#:

Y ☐ / N ☒ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Seasonal Wetland / Pajaro River

Projection:
Datum:
Coordinates:

Potential anthropogenic influences on the channel system: Section of Pajaro River has been straightened. Normal circumstances are not present due to drought.

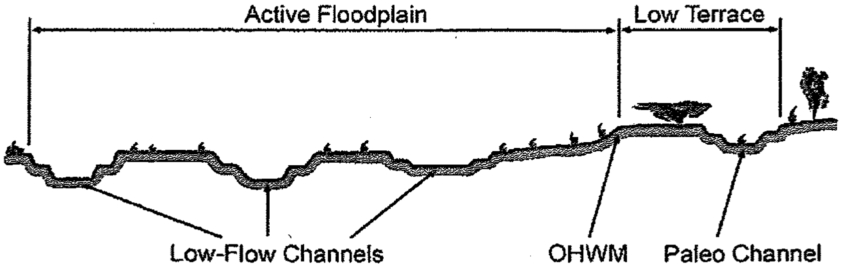
Brief site description: Vault at SCC #19 is above top of bank of river. ~200' N of lake/mitigation area. Seasonal wetland in channel dominated by Distichlis spicata. No standing/flowing water. Annual grassland is adjacent to channel.

Checklist of resources (if available):

☒ Aerial photography
Dates: 2005-2013
☒ Topographic maps
☐ Geologic maps
☐ Vegetation maps
☒ Soils maps
☐ Rainfall/precipitation maps
☐ Existing delineation(s) for site
☒ Global positioning system (GPS)
☐ Other studies

☐ Stream gage data
Gage number:
Period of record:
☐ History of recent effective discharges
☐ Results of flood frequency analysis
☐ Most recent shift-adjusted rating
☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

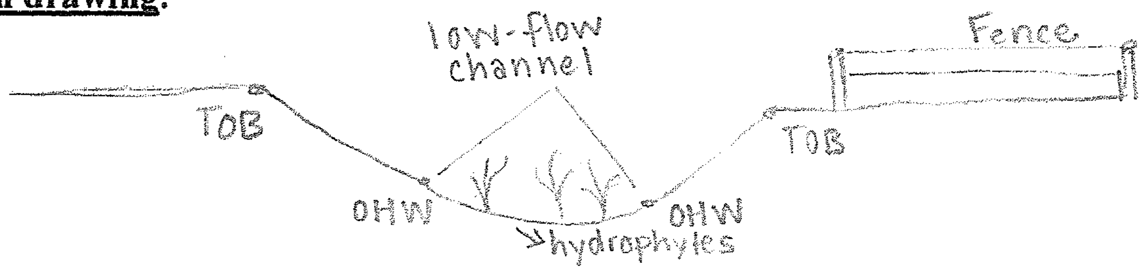


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   ☐ Mapping on aerial photograph
   ☒ GPS
   ☐ Digitized on computer
   ☐ Other:

Project ID: 3270.35 **Cross section ID:** W19 **Date:** 3/6/14 **Time:** 930am

Cross section drawing:



OHWM

GPS point: OHW19 - 36.98074 / -121.48923

Indicators:

☐ Change in average sediment texture
☒ Change in vegetation species
☐ Change in vegetation cover
☒ Break in bank slope
☒ Other: Drainage patterns
☐ Other: ______

Comments:

Slight break in slope at OHW's.
Hydrophytes below OHW's vs. upland species on banks & terraces.
Vegetation is matted in one direction below OHW's.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: same as above

Characteristics of the floodplain unit:
Average sediment texture: clay/medium silt
Total veg cover: 100 % Tree: ___ % Shrub: ___ % Herb: X %
Community successional stage:

☐ NA
☒ Early (herbaceous & seedlings)
☐ Mid (herbaceous, shrubs, saplings)
☐ Late (herbaceous, shrubs, mature trees)

Indicators:

☐ Mudcracks
☐ Ripples
☐ Drift and/or debris
☒ Presence of bed and bank
☐ Benches
☐ Soil development
☐ Surface relief
☒ Other: Drainage patterns
☐ Other: ______
☐ Other: ______

Comments:

Low-flow channel corresponds to OHW's
upper terrace would recieve flows in 100-yr events.

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: South County Right of Way
Project Number: 3270-35
Stream: ES34
Investigator(s): M. Goklany
Date: 3/11/14
Town: San Benito Co.
Photo begin file#:
Time: 2:00 pm
State: CA
Photo end file#:

Y ☐ / N ☒ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Ephemeral section of Elephant Head Creek

Projection:
Datum: WGS84
Coordinates:

Potential anthropogenic influences on the channel system:
Near Highway 152. Banks to upper terraces are heavily eroded + a large headcut is present. Normal circumstances are not present due to drought.

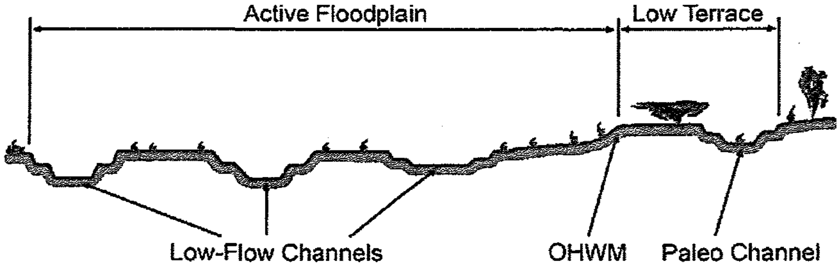
Brief site description:
Drainage surrounded by annual grassland (on banks + above top of bank). Riparian shrubs (e.g. Baccharis salicifolia) are present in the channel + on lower terrace. No standing or flowing water. Two low-flow channels are present.

Checklist of resources (if available):

☒ Aerial photography
Dates: 2005-2013
☒ Topographic maps
☐ Geologic maps
☐ Vegetation maps
☒ Soils maps
☐ Rainfall/precipitation maps
☐ Existing delineation(s) for site
☒ Global positioning system (GPS)
☐ Other studies

☐ Stream gage data
Gage number:
Period of record:
☐ History of recent effective discharges
☐ Results of flood frequency analysis
☐ Most recent shift-adjusted rating
☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



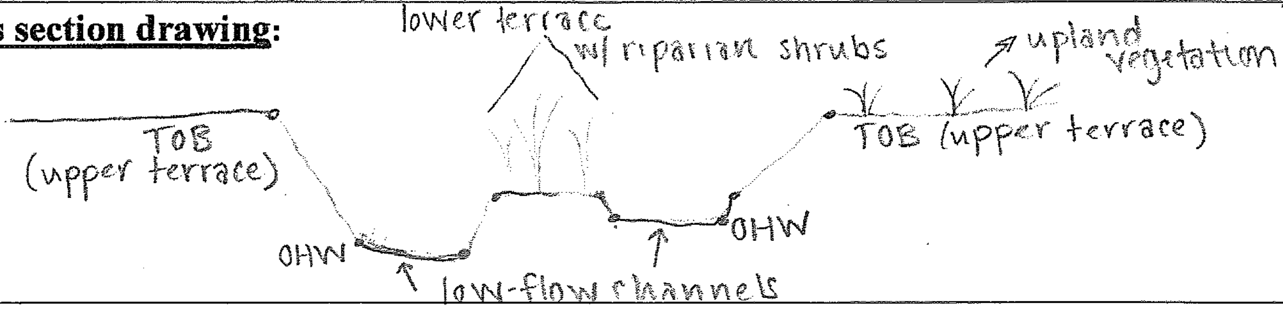
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:

☐ Mapping on aerial photograph
☐ Digitized on computer
☒ GPS
☐ Other:

Project ID: 3270-35 **Cross section ID:** ES 34 **Date:** 3/11/14 **Time:** 2:00 pm

Cross section drawing:



OHWM

GPS point: OHW - 37.00839/-121.36044

Indicators:

☒ Change in average sediment texture
☒ Change in vegetation species
☒ Change in vegetation cover
☒ Break in bank slope
☒ Other: Drift & debris
☒ Other: Drainage patterns

Comments:
Vegetation is matted in one direction & drift/debris are present on lower terrace and in low-flow channels. Sediment texture changes from cobbles & gravels below OHW's to medium silt on banks. Riparian vegetatio is present below OHW's, while banks are bare & eroded. Upland vegetati on upper terraces.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: same as above

Characteristics of the floodplain unit:
Average sediment texture: cobbles, gravels
Total veg cover: 5 % Tree: ___% Shrub: ___% Herb: ___%
Community successional stage:

☐ NA
☒ Early (herbaceous & seedlings)
☐ Mid (herbaceous, shrubs, saplings)
☐ Late (herbaceous, shrubs, mature trees)

Indicators:

☐ Mudcracks
☐ Ripples
☒ Drift and/or debris
☒ Presence of bed and bank
☐ Benches
☐ Soil development
☐ Surface relief
☒ Other: Drainage Patterns
☐ Other: ___
☐ Other: ___

Comments:
A 2-3' high mound is present between the low-flow channels (lower terrace). Drift & debris were present in the low-flow channels. Riparian shrubs were present on the low terrace. Less vegetative cover in the low-flow channels. The upper terrace would recieve flows in 100yr events

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: South Co. Right of Way
Project Number: 3270-35
Stream: ES57
Investigator(s): M. Goklany

Date: 3/5/14 **Time:** 8 am
Town: Santa Clara **State:** CA
Photo begin file#: Co. **Photo end file#:**

Y ☐ / N ☒ Do normal circumstances exist on the site?

Y ☒ / N ☐ Is the site significantly disturbed?

Location Details: Ephemeral section of Tennant Creek

Projection: **Datum:**
Coordinates: WGS84

Potential anthropogenic influences on the channel system: Residential area (house + livestock pen) at or below top of bank. Dirt pathway crosses creek, no culvert underneath. Normal circumstances are not present due to drought.

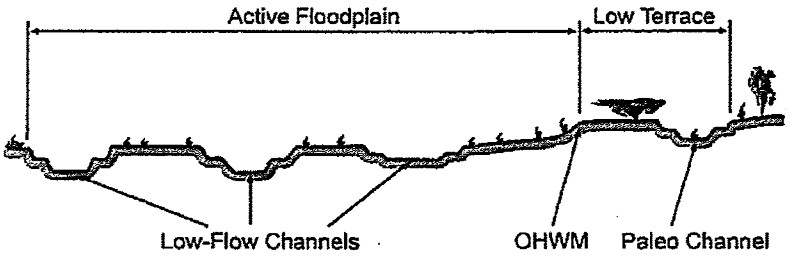
Brief site description: Vault at SCCHS7 is just outside top of bank. Upland veg. (Vinca major) is present in channel. Small portion of channel is a seasonal wetland dominated by Mentha spicata. Creek runs alongside rural residences, greenhouses, and field used for row crops.

Checklist of resources (if available):

☒ Aerial photography
Dates: 1993, 1998, 2003-2013
☒ Topographic maps
☐ Geologic maps
☐ Vegetation maps
☒ Soils maps
☐ Rainfall/precipitation maps
☐ Existing delineation(s) for site
☒ Global positioning system (GPS)
☐ Other studies

☐ Stream gage data
Gage number:
Period of record:
☐ History of recent effective discharges
☐ Results of flood frequency analysis
☐ Most recent shift-adjusted rating
☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



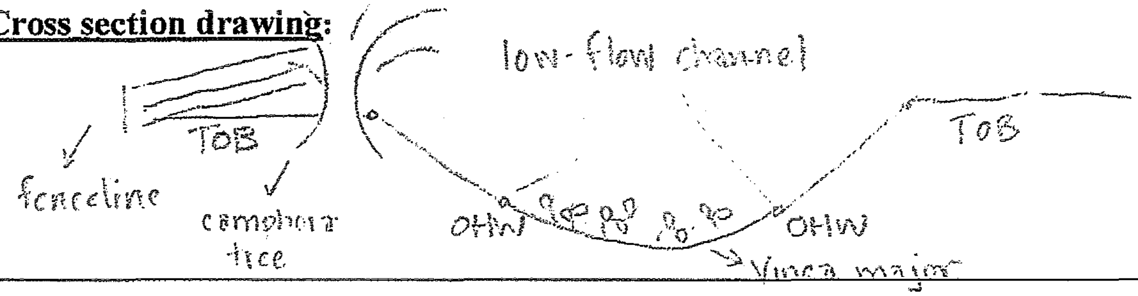
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:

☐ Mapping on aerial photograph ☒ GPS
☐ Digitized on computer ☐ Other:

Project ID: 3270-35 **Cross section ID:** ES57 **Date:** 3/5/14 **Time:** 8am

Cross section drawing:



OHWM

GPS point: OHW57A - 37.12528/-121.60666
OHW57B - 37.12528/-121.60667

Indicators:

☐ Change in average sediment texture
☐ Change in vegetation species
☒ Change in vegetation cover
☐ Break in bank slope
☒ Other: drainage patterns
☐ Other:

Comments: Higher percent cover of bare ground below OHWs
Vegetation is matted in one direction and woody debris/ herbaceous litter are present at OHWs

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: same as above

Characteristics of the floodplain unit:

Average sediment texture: Medium silt
Total veg cover: 40 % Tree: 20 % Shrub: ___ % Herb: 20 %
Community successional stage:

☐ NA
☐ Early (herbaceous & seedlings)
☐ Mid (herbaceous, shrubs, saplings)
☒ Late (herbaceous, shrubs, mature trees)

Indicators:

☐ Mudcracks
☐ Ripples
☒ Drift and/or debris
☒ Presence of bed and bank
☐ Benches
☐ Soil development
☐ Surface relief
☒ Other: Drainage patterns
☐ Other:
☐ Other:

Comments: Low-flow channel corresponds to OHW's. Cinnamomum camphora (tree) overhangs into channel. Vinca major in streambed + extends up banks (there is higher percentage of bare ground in the streambed.) Upper terraces would recieve flows in 100-yr events.

Appendix E. Photo-documentation

Photo 1. Vault at SCC8 in upland habitat.

Photo 2. Ephemeral stream at SCC8.

Photo 3. Upland habitat at SCC11.

Photo 4. Seasonal Wetland at SCC11

Photo 5. Perennial marsh surrounding the vault at SCC12 with berm (upland habitat) in background.

Photo 6. Vault at SCC17 in upland habitat.

Photo 7. Vault at SCC18 in upland habitat.

Photo 8. Vault at SCC19 in upland habitat.

Photo 9. Seasonal wetland within an ephemeral section of the Pajaro River at SCC19.

Photo 10. Vault at SCC20 in upland habitat.

Photo 11. Upland/wetland boundary at SCC21.

Photo 12. Standing water in seasonal wetland at SCC21.

Photo 13. Irrigation ditch at SCC21 is routinely cleared of vegetation.

Photo 14. Vault at SCC22 in upland habitat.

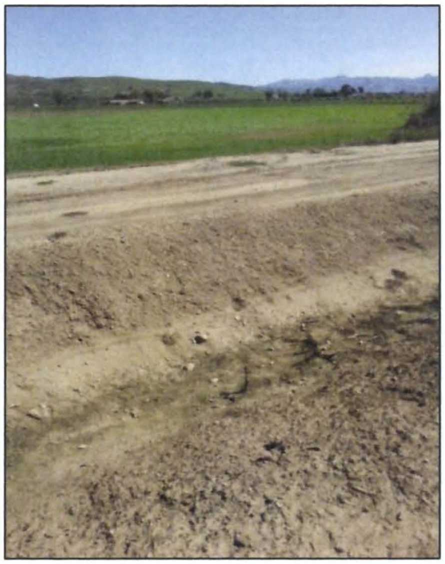


Photo 15. Irrigation ditch at SCC22 is routinely cleared of vegetation.

Photo 16. Vault at SCC23 in upland habitat.

Photo 17. Vault at SCC24 in upland habitat.

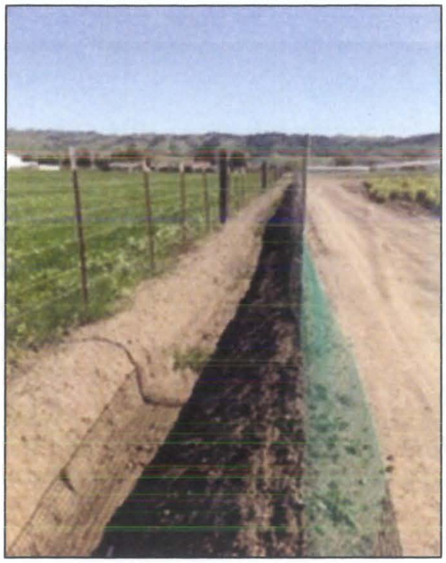


Photo 18. Irrigation ditch at SCC24 is routinely cleared of vegetation.

Photo 19. Vault at SCC25 in upland habitat.

Photo 20. Vault at SCC26 in upland habitat.

Photo 21. Vault at SCC30 in upland habitat.

Photo 22. Vault at SCC34 in upland habitat.

Photo 23. Existing gate at SCC34.

Photo 24. Vault at SCC35 in upland habitat.

Photo 25. Possible gate location to access SCC35 in upland habitat.

Photo 26. Irrigation ditch along the access road to SCC35 is routinely cleared of vegetation.

Photo 27. Gate location in upland habitat to access SCC40.

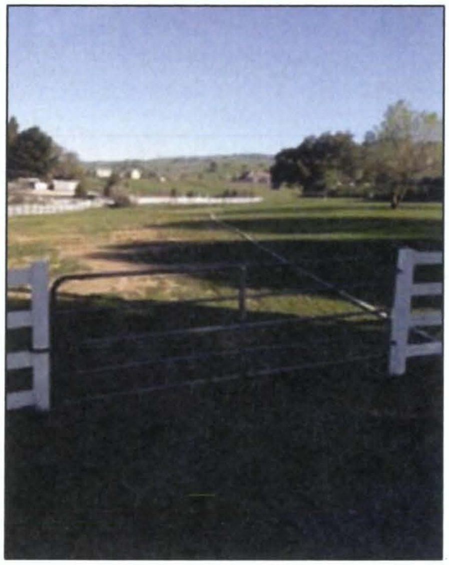


Photo 28. Existing gate at driveway location in upland habitat to access SCC43.

Photo 29. Existing gate to access SCC50 in upland habitat.

Photo 30. Upland/wetland mosaic at SCC52.

Photo 31. High water table in the seasonal wetland at SCC52.

Photo 32. Surface water in the seasonal wetland at SCC52.

Photo 33. Gate location at SCC53. Driveway passes over culvert and ephemeral stream.

Photo 34. Culvert and roadside ditch at SCC53.

Photo 35. Vault at SCC54 in upland habitat.

Photo 36. Irrigation ditch and upland habitat at SCC54.

Photo 37. Vault and upland habitat at SCC57.

Photo 38. Seasonal wetland within ephemeral section of Tennant Creek at SCC57 (photo was taken in early March).

Photo 39. Seasonal wetland at SCC57 (photo was taken in late April).

Photo 40. Vault at PC2 just outside top of bank.

Photo 41. Upland/wetland boundary at PC2.

Photo 42. Surface water in seasonal wetland at PC2.

Photo 43. The OHW marks of Pacheco Creek, a perennial stream, are outside the project boundary at PC2.

Photo 44. Vault at PC34 just outside the top of bank in upland habitat.

Photo 45. Ephemeral section of Elephant Head Creek at PC34.

Appendix F. Aquatic Resources Table

Waters_Name	Cowardin_Code	HGM_Code	Measurement_Type	Amount	Units	Measurement_Type	Amount	Units	Waters_Types	Latitude	Longitude	Local _Waterway
PM12	PEM1H		Area	0.03507	Acre	Linear	47	FOOT	RPWWN	36.97068	-121.4412	Oretga Creek
SW11	PEM2C		Area	0.01834	Acre	Linear	51	FOOT	RPWWN	36.96878	-121.4324	Oretga Creek
SW52	PEM2C		Area	0.02755	Acre	Linear	40	FOOT	RPWWD	37.10408	-121.5832	San Martin Creek
SW57	R4SB7C		Area	0.00081	Acre	Linear	12	FOOT	RPWWD	37.12534	-121.6067	Tennant Creek
SW2	PEM2C		Area	0.00192	Acre	Linear	40	FOOT	RPWWD	37.04297	-121.2732	Pacheco Creek
SW19	R4SB7C		Area	0.00025	Acre	Linear	5	FOOT	TNWW	36.98074	-121.4892	Pajaro River
SW21	PEM2C		Area	0.01364	Acre	Linear	141	FOOT	RPWWN	36.98870	-121.5010	Jones Creek and San Ysidro Creek
ES8	R4SB7C		Area	0.00059	Acre	Linear	12	FOOT	RPW	36.97460	-121.4151	Unnamed Tributary, Pajaro River Watershed
ES57	R4SB7C		Area	0.00241	Acre	Linear	31	FOOT	RPW	37.12529	-121.6067	Tennant Creek
ES34	R4SB3C		Area	0.00072	Acre	Linear	11	FOOT	RPW	37.00840	-121.3604	Elephant Head Creek